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NEW PHILIPPINE FERNS, IX

By EDWIN B. COPELAND
University of California, Berkeley, California

TWENTY-SIX PLATES

The species herein described have been collected over a period of more than forty years, during which the most of them have, for one or another reason, been left unnamed in the herbarium. In the preparation of a Fern Flora of the Philippines, now in manuscript, the time has come when, if ever, they should be described. There remain of course others still undetermined, in most cases because the material is too inadequate.

The types, except as otherwise stated, are in my own herbarium. This and the United States National Herbarium contain, since the destruction of the Philippine National Herbarium, the greatest collections of Philippine ferns. For the preparation of the Fern Flora, I have been able to borrow the entire material of the U. S. National Herbarium in critical genera, and, I suppose, all undetermined specimens; this assistance is cordially appreciated.

In most genera, even in such huge ones as *Cyclosorus, Cyathea* and *Athyrium,* the distinctions of novelties are usually evident even conspicuous.

In the group of *Pteris quadriaurita,* I have undertaken reluctantly to follow Hieronymus' policy of fine discrimination, but have wondered how the often inconspicuous, and sometimes apparently inconsequential distinctions could be maintained in nature against blurring and eventual disappearance as the consequence of cross-fertilization. An explanation now appears. They do not cross-fertilize because their reproduction is commonly apogamous. The studies of Mrs. Giauque have shown

that this phenomenon is far commoner than has been suspected. It has not been possible as yet to get viable spores of the novelties here described, but we do know now that not only was *Pteris* the genus in which apogamy was first discovered, but that it is one of the genera in which the process is common. However a peculiarity may originate, it may be expected to be effectively frozen and to be a characteristic of descendants apogamously reproduced. Obviously, strains or races so reproduced are clones, rather than species in the usual sense. But, so long as there is no way of recognizing in nature a distinction between clones and species, I see no choice but to treat them all as species when they come in for identification.

MECODIUM EDANOI Copel., sp. nov.

M. M. anguloso affine, lamina minus laxa, valvis integris, et receptaculo plerumque extruso distinctum; stipite 3–5 cm alto, gracile, tereto, castaneo; lamina usque ad 13 cm longa, 5 cm lata, bi-tripinnatifida, sublaxa, rhachi deorsum tereta, segmentis 1 mm latis; indusiis 2 mm longis, 1.5–2 mm latis, valvis late rotundatis vel subtruncatis, integris; receptaculo elongato-cylindrico, plerumque paullo extruso.

MINDORO: Mt. Ilong, *Phil. Nat. Herb. 3879 G. E. Edaño.*

Mt. Ilong is a spur of Mt. Halcon, the type locality of *M. angulosum.* The two species are similar enough to seem related, but are well distinguished by the characters of the sorus. Protruded receptacles are excluded by the formal definition of *Mecodium,* but in this case there is no question about the affinity. There is also *M. protrusum* (Hooker) Copel. in Jamaica, more conspicuous in this respect.

MICROTRICHOMANES ZAMBOANGANUM Copel., sp. nov. **Plate 1, fig. 1.**

Stipite capillare ca. 1 cm alto; lamina ca. 1.5 cm longa, 5–8 mm lata, pseudopinnatifida,–i. e., iterum dichotoma cum segmentis alternantibus brevibus,-segmentis ca. 2 mm latis vel apices versus paullo latioribus, marginibus haud setuliferis; involucro cum tubo 1.5 mm longo cylindrico immerso, deinde abrupte dilatato orbiculare, cum segmento aequilato.

MINDANAO, epiphytic in mossy forest, in mountains back of San Ramon, alt. 1,200 m; known by a single collection.

Distinguished from *M. vitiense,* of which I have now good material from Fiji, by elongate stipe, more divided and monopodial frond, and particularly by the form and size of the involucre. I still do not see how *Trichomanes Aswijkii* Racob. is distinguished from *M. vitiense.* As to *T. Powellii* Baker, see Christensen, Bishop Museum Bull. **177** (1943) 13.

The location of these species in *Microtrichomanes* is uncertain, as their extreme reduction may have involved the loss of structures which would show their phylogeny. The involucre of *M. zamboanganum* is like that of *Crepidomanes Christii.*

If it happens to be so pressed when collected, the mouth of the involucre of *M. zamboanganum* might be described as bilabiate. Likewise, if a circular piece of paper be evenly folded, it looks bilabiate; but that is not the usual and proper meaning of the word.

STICHERUS PERPALEACEUS Copel., sp. nov.

S. S. Loheri affinis, rhachibus superne paleis angustis et piliformibus debilibus appressis laceris albis obtectis, inferne paleis squarrosis lanceolatis et ovato-lanceolatis ca. 3 mm longis lacerato-ciliatis pulcherrime cinnamomeis recte patentibus dense vestitis, etiam costis inferne pilis et squamulis concoloribus furfuraceis; internodiis 4 pinnuliferis, pinnulis inferioribus haud contiguis, 9–12 mm longis, basi usque ad 4 mm latis, superioribus contiguis, superne nigris inferne obscuris, rigide coriaceis.

LUZON, Mt. Pulog, Benguet, alt. 2,700 m, *Bur. Sci. 44999 Ramos* and *Edaño,* Type in Herb. Univ. Calif.

Incomparably the most densely paleate Philippine *Sticherus.*

HICRIOPTERIS PALEACEA Copel., sp. nov.

Gleichenia gigantea COPEL., Elmer's Leaflets 2 (1908) 424, non. Wall.

H. rhachide brunnea superne paleis albidis linearibus usque ad 5 mm longis lacerato-ciliatis cum squamulis concoloribus intergradientibus appressis minutis hic illuc abrasis, inferne paleis fulvis lanceolatis pallidius marginatis 3–4 mm longis vestitis; pinnulis inter se 2 cm remotis, subimbricatis, recte patentibus, sessilibus, usque ad 20 cm longis, rhachillis superne deorsum paleis piliformibus pallidis sparsis plus minus deciduis vestitis, sursum mox glabratis, inferne paleis ferrugineis pallidius marginatis, late lanceolatis attenuatis apices versus irregulariter ciliatis vestitis; segmentis ca. 13 mm longis, 3 mm latis anguste confluentibus, apice rotundatis, margine deflexis, coriaceis, superne fere nigris, pilis paucis deciduis albis ornatis, inferne pallidis; costis superne paleis parvis squamulisque laceris ferrugineis plus minus deciduis vestitis, segmentis superioribus glabratis; venis superne conspicue impressis, facie ideo pseudobullatis sed facie inferiore plana.

NEGROS, Cuernos of Negros, alt. 1,600 m, *Elmer 9902.*

Elmer's field notes state that the primary pinnae are 60 cm apart, 1 to 2 m long; "in humid woods; sprawling over

thickets, and upon exposed ridges, forming large tangled masses; stems green and covered with scales."

The nearest resemblance is to *H. volubilis* (Jungh.) Ching, from which it differs in less dense and less dissected, therefore not "arachnoid" indument, and in the absence of darke paleae.

DICRANOPTERIS CURRANII Copel., sp. nov.

D. stipite castaneo glabro 5 mm crasso; stipula infime 30–35 cm longa, 14 cm lata, segmentis usque ad 7.5 cm longis utroque latere usque ad 55; pinnis 60 cm longis, pinnulis ca. C-paribus, 5–7.5 cm longis, 3–4 mm latis, obtusis, crassiusculis, fragilibus, viridibus non glaucis; venulis plerumque 4, confertis; soris parvis, sporangiis 4–6.

LUZON, Laguna Province, *Bur. For. 19265 Curran,* Feb. 1910.

Remarkable for large stipules and pinnae, and exceedingly numerous long, narrow, thin but brittle, non-glaucous segments.

DENNSTAEDTIA MACGREGORI Copel., sp. nov. **Plate 2.**

Ex affinitate D. Smithii species foliis multo angustius dissectis; rhachi (verosimiliter ex part mediale frondis) 8 mm crassa, pube densa breve fusca vestita; pinna 60 cm longa, 21 cm lata, pinnulis^{i} brevipedicellatis, imbricatis basi 3–4 cm latis, acutis, herbaceis, fusco-viridibus, pinnulis^{iii} infimis acroscopicis 8 mm longis, ad costas setis paucis pallidis ornatas anguste alatas pinnatisectis, segmentis utroque latere 1 vel 2, 0.5 mm latis, aut ad apicem aut ad latus acroscopicum soro 1 mm lato dilatatis.

LUZON, Ifugao Subprovince, Mt. Polis, *Bur. Sci. 19168 McGregor,* February, 1913.

By far the most finely dissected of our large *Dennstaedtia* species.

DENNSTAEDTIA FUSCA Copel., sp. nov. **Plate 3.**

D. gregis D. glabratae, stipite atropurpureo nitido, sursum sparsissime aculeato, nisi in sulca glabra; lamina 120 cm longa, subtripinnata, rhachibus minoribus etiam atropurpureis, aculeis parvis acutis nigris horridis; pinnis remotis oppositis ad rhachin articulatis, infimis invisis, sequentibus 45 cm longis, 10 cm latis, acuminatis; pinnulis infimis subsessilibus, inferioribus oppositis, fere ad costam pinnatisectis; segmentis infimis 12–15 mm longis, 6 mm latis, late rotundatis, ad soros leviter incisis aliter integris vel obscure denticulatis, brunneo-viridibus; soris 1 mm latis, deflexis.

PANAY, Capiz Province, Mt. Madiaas, *Bur. Sci. 30674 Ramos* and *Edaño*. Type in U. S. Nat. Herbarium.

Like *D. Elmeri* in the densely spinulose minor rachises, but with fewer and shorter pinnules, and much fewer and broader, more entire segments. The spinulose dark minor rachises distinguish it from *D. glabrata, D. articulata* and *D. ampla*. The rhizome and the base of the stipe are unknown.

MICROLEPIA PROTRACTA Copel., sp. nov.

Stipitis parte visa castanea, glabrata, gracile (5 mm crassa); lamina ultra 2 m alta, ovata, rhachi deorsum glabrescente, sursum rhacibusque pinnarum dense minute pubescentibus; pinna mediale 50 cm longa, pedicellata, pinnulisque majoribus caudato-acuminatis; pinnulis 10 cm longis, basi 3 cm latis obliquis, deorsum pinnatis, pinnula[ii] infima acroscopica quam sequentibus duplo majore, sessile, lanceolata, acuta, deorsum profunde incisa, papyracea, costa inferne sparse pubescente excepta fere glabra; soris modo impressis, late inframarginalibus, indusiis semicupuliformibus, firmis, brunneis, varie truncatis sed lateribus adnatis plerumque sursum (interdum usque ad marginem) protractis.

BALUT ISLAND, *Merrill 5427*. October, 1906.

I have thought that this might be the *Davallia manilensis* of Prantl and Christ, which has another name, *Davallia Sarasinorum* Christ. The very peculiar indusia might have been overlooked. But Christ described his plant as "die ganze Pflanze von kurzen, bräunlichen Haaren rauh"; while the Balut specimen is almost completely glabrous.

LINDSAEA ANGUSTA Copel., sp. nov. **Plate 4.**

L. L. pectinatae affinis, fronde lineare distincta; rhizomate scandente 2 mm crasso; stipitibus 2–5 cm longis, teretibus, fuscescentibus; frondibus 30–40 cm longis, 2 cm latis, deorsum decrescentibus, pinnis infimis minutis fissis; pinnis caeteris contiguis, pedicellatis, rhomboideis vel plus minus triangularibus, apice rotundatis vel subacutis, 5 mm latis, margine acroscopico remote et irregulariter incisulis, herbaceis, venis nisi in soris liberis; indusiis plerumque cum margine conterminantibus.

MINDANAO, Davao Province, Mt. Kampalili, "along ridge in forested slopes," alt. 2,100 and 2,196 (summit) meters, *Phil. Nat. Herb. 8791* (type) and *8764 G. E. Edaño*.

Evidently a local derivative of *L. pectinata*, distinct in appearance because of the linear fronds; the pinnae tend to be

triangular, and the reduced basal pinnae are dissected. The two ample collections are uniform.

LINDSAEA CULTRIPINNA Copel., sp. nov.

L. gregis L. macraeanae, propter pinnas valde recurvas inter affines peculiaris; stipite 5–12 cm alto; lamina 30 cm longa, 3.5 cm lata, rhachi straminea inferne tereta; pinnis infimis modo decrescentibus, sequentibus omnibus conspicue recurvis, brevissime pedicellatis, basi 5 mm latis, latere acroscopico regulariter ¼–⅓ ad costam incisis, latere basiscopico omnino excisis; soris ad lobos solitariis, apicalibus, indusiis parvis vel evanescentibus.

MINDANAO, Bukidnon Province, Mt. Katanglad, alt. 2,000 m., *Phil. Nat. Herb. 8718 M. D. Sulit.*

Some pinnae are more deeply incised toward the apex, and narrower there, in a manner suggesting *L. apoensis.*

LINDSAEA DECRESCENS Copel., sp. nov. **Plate 5.**

L. macraeanae affinis, inter L. longam et L. fissam medium tenens; rhizomate scandente, 1.2 mm crasso; stipitibus 1–3 cm longis, gracilibus, atropurpureis; fronde 30 cm longa, 2 cm lata, praecipue deorsum longe attenuata, rhachi straminea, quadrangulata; pinnis infimis modo remotis ad vestigia bifida vel trifida reductis, medialibus contiguis brevissime pedicellatis, rhachin secus 5 mm latis, basi deflexo-cuneatis, apice obtusis, margine basiscopico leviter recurvis, acroscopico irregulariter plus minus ad mediam laminam incisis, herbaceis, segmentis truncatis plerisque 1.5 mm latis; venis apices pinnarum versus simplicibus, alibi furcatis et venis in soris confluentibus; soris latetudinem segmenti aequantibus, vix terminalibus, indusio breve mox evanido.

LUZON, Quezon Province, Umiray, *Loher 13621,* May, 1915.

LINDSAEA ROXASII Copel., sp. nov.

L. macraeanae affinis, lamina fere hyalina, venulis remotis, soris majoribus paucioribus distincta; rhizomate 1.5–2 mm crasso, alte scandente; stipite 1.5–2 cm longo; fronde 35–45 cm longa, 3 cm lata, deorsum sensim angustata; pinnis subsessilibus, erecto-patentibus, 15 mm longis, basi 7 mm latis, deinde ad apices rotundatos angustatis, leviter lobatis, venis plerumque 5, inferioribus furcatis, ramis in basibus sororum interdum confluentibus, soris fere marginalibus.

MINDANAO, inter montes Apo et Calelan, alt. 2,100 m, ad truncos permuscosos, *Copeland, Pterid. Phil. Exsicc. 259;* September 6, 1932.

Named in honor of Doctor Manuel Luz Roxas, then Director of the Bureau of Plant Industry.

PTERIS BREVIS Copel., sp. nov.

P. rhizomate adscendente, paleis lineari-aciculatis castaneis 2–3 mm longis vestito; stipitibus caespitosis, ca. 20 cm longis, basi fuscis sparsissime paleatis sursum brunneis nudis, gracilibus; lamina 10–14 cm longa, fere aequilata, parte distale ad alam 0.5 mm latam pinnatifida 7–11 cm longa, 1.5–2.5 cm lata, caudata; pinnis infimis furcatis cum auricula grande segmentis usque ad 20-paribus; pinnis lateralibus 1-paribus, sessilibus vel adnatis, brevicaudatis, segmentis 2.5 mm latis, integris, obtusis, papyraceis, basibus et apicibus sterilibus perbrevibus; costis superne infra insertiones costularum spinis pallidis conspicuis ca. 1.3 mm longis ornatis.

BASILAN, Land Grant of the University of the Philippines, of plants distributed by the Universities of Michigan and the Philippines, *Ebalo 917*.

PTERIS DATAENSIS Copel., sp. nov.

P. rhizomate suberecto, basique imo stipitis paleis lanceolato-attenuatis 3–4 mm longis ebeneis ferrugineo-marginatis vestitis; stipite 45–55 cm alto, brunneo; lamina aequilonga, parte apicale 12 cm longa, 20–22 mm lata, brevi-caudata, basi abrupte angustata; pinnis infimis 18 cm longis, latere basiscopico pinnulis 3 vel 4 parti apicali frondis similibus praeditis; pinnis lateralibus ca. 3-paribus, inferioribus subsessilibus, 15 cm longis, 2 cm latis, acuminatis vel subcaudatis, ad alam 0.5 mm latam pinnatisectis sinubus angustis, costa superne spinis 1.5 mm longis munitis, costulis spinulis minoribus ornatis, segmentis arcte contiguis, 3.5 mm latis, apice rotundatis, herbaceis; venis furcatis sat remotis; soris sinu et apice ca. 1 mm remotis.

LUZON, Mt. Province, Mt. Data, *Copeland 1876*, alt. 2,100 m, Mt. Pulog, *Bur. Sci. 8817 McGregor*.

Well characterized by its compact frond, with numerous narrow pinnae and very numerous segments.

PTERIS ELMERI Christ *in herb.*, sp. nov.

P. gregis P. creticae frondibus dimorphis; paleis rhizomatis 3–4 mm longis, angustis, atrocastaneis; stipite 30–40 cm longo, gracile, obscuro vel sursum straminescente, lamina aequilonga, pinnis infimis et interdum sequentibus furcatis, foliola terminale fere ad basin trifurcata et deinde decurrente, frondis sterilis pinnis lateralibus saepe 3-paribus, 15–20 cm longis, 2.5 cm latis, oppositis, sessilibus, papyraceis, pallide viridibus, margine anguste cartilagineo-cinctis et argute cartilagineo-spinoso-ser-

ratis, venis conspicuis et simplicibus et furcatis, inter se 1–1.5 mm remotis; frondis fertilis pinnis valde remotis, 3–5-paribus, 15–25 cm longis, ca. 5 mm latis, inferioribus pedicellatis, indusio 0.5 mm lato.

LUZON, Bontoc Subprovince, Sagada, alt. 1,600 m, on limestone, *Copeland 1903*, type; Benguet Subprovince, *Elmer 6313 Merrill, Phil. Plants 981*, sterile, *Merrill 11666*, fertile, *Bur. For. 16305*, Mt. Pulog, alt. 2,100 m, somewhat depauperate. *Merrill, Phil. Plants 676* is considerably larger, the stipe of the fertile frond 1 m long, and the lower pinnae bearing furcate pinnules, but it surely represents the same species.

These specimens have been distributed as *P. cretica* and *P. pellucida*. They are distinguished from the former by dimorphism; from the latter by spinose-serrate margins and apices and forked segments.

PTERIS EDANYOI Copel., sp. nov. **Plate 1, fig. 2.**

Litobrochia segmentis maximis, rhizomate et stipite invisis; lamina magna tripartita, parte laterale 60 cm longa, furcata, ramo basiscopico 30 cm longo, acroscopico 55 cm longo, ambobus bipinnatifidis, pinnis majoribus 20 cm longis, 7–9 cm latis, in caudas inconspicue serratas acuminatas protensis, ad alam 2–3 mm latam pinnatifidis, segmentis 6–7 mm latis, herbaceis, costa superne inerme, venis infimis areolam costalem angustissiman includentibus, areolis alibi aut magnis aut nullis; soris ad sinus, non ad apices protensis, indusio angusto.

LUZON, Rizal Province, Mt. Lomutan, *Bur. Sci. 29609 Ramos* and *Edaño*, July, 1917. Type in U. S. Nat. Herb.

Unique in its group because of its very large segments. Hybridization of *P. excelsa* and *P. tripartita* might produce such a plant. "Lumutan" signifies "the mossy place," indicating considerable altitude.

PTERIS LOHERI Copel., sp. nov. **Plate 1, fig. 3.**

Campteria pedata forma P. tripartitae; stipite 40 cm alto deorsum fusco paleis concoloribus pellucidis ovatis 3 mm longis dense vestito, sursum glabrescente ferrugineo; lamina vix 30 cm alta, tripartita partibus lateralibus bis furcatis; pinnis partis axialis contiguis, sessilibus, usque ad 5.5 cm longis et 12 mm latis, acutis vel acuminatis, tenuiter coriaceis, superne atroviridibus, ad alam 0.6 mm la-tam pinnatifidis, costa superne interdum spinulifera, segmentis ca. 1.6 mm latis, bullatis, obtusis; venis infimis aut ad sinus conniventibus aut liberis; soris ad sinus et apices protensis, indu—siis latis.

LUZON, Benguet Subprovince, La Trinidad (Capunga), *Loher 1290,* April, 1897. Type in U. S. Nat. Herb.

This looks like a dwarfed and congested *P. tripartita,* but differs in too many respects,–notably venation and paleae,–to be referred to that species. Still, it may be the collection reported by Christ, Bull. Boiss. **6** (1898) 148, as *P. tripartita,* "Hab. Trinidad II. 2,300 m."

PTERIS MELANORHACHIS Copel., sp. nov.

P. P. pacifica affinis, pinnis sessilibus et segmentis angustis distincta; rhizomate breve adscendente, paleis castaneis 2 mm longis; stipite 35–50 cm longo, gracile, ebeneo, nitido, facie ventrale sulcato; lamina 30–35 cm longa, rhachi costisque ultra mediam longitudinem ebeneis; pinnis infimis furcatis 15–20 cm longis, lateralibus ca. 5–paribus sessilibus, caudatis caudis 3 cm longis 1.5 mm latis undulatis vel integris, ad alam 0.3 mm latam costae pinnatifidis, segmentis usque ad 2 cm longis et 2.5 mm latis, rectis obtusis, herbaceis, venulis prope costulam furcatis, costa superne spinis plerisque 0.6 mm (rarius 1–1.5 mm) longis praedita, spinis ad costulas raris, nec ad sinus omnino carentibus; soris fere ad sinus et apices protractis, indusio angusto.

LUZON, Camarines Norte Province, Paracale, *Bur. Sci. 33802 Ramos* and *Edaño.* Type in U. S. Nat. Herb.

Distinguished from all apparently related species with black axes, by slender stipe and rachis and narrow segments.

PTERIS MACGREGORI Copel., sp. nov. **Plate 6.**

P. paleis castaneis lanceolato-attenuatis 2–3.5 mm longis; stipite 13–20 cm longo, rhachique fulvo-brunneis glabris; lamina ca. 20 cm longa, parte terminale (cauda usque ad 7.5 cm longa inclusa) 13 cm longa, ubi pinnatisecta 2 cm lata; pinnis infimis furcatis, segmentis auriculae paucis; pinnis lateralibus ca. 4-paribus, sessilibus, rectis vel falcatis, longe caudatis, fere ad costam pinnatis, segmentis 10–14 mm longis, 3–4 mm latis, integris, obtusis, papyraceis, segmento infimo basiscopico saepe aucto, venis furcatis; costa ad insertionem costulae spina 0.6–1.0 mm longa munita, nec carent omnino spinae solitariae ad costulas; soris angustis, apice remotis.

LUZON, Nueva Vizcaya Province, near Dupaz, *Bur. Sci. 14305 McGregor.*

Near the bases of pinnae, the segments are sometimes dwarfed or obsolete.

PTERIS MUCRONULATA Copel., sp. nov. **Plate 7**

P. rhizomate basique stipitis paleis lineari-setiformibus 5–6 mm longis atrocastaneis vestitis; stipite 20 cm vel ultra longo, stramineo vel plumbeo; lamina 10–15 cm longa, parte terminale subpinnata 8–9 cm longa, pinnis lateralibus 1-paribus subpinnatis, sessilibus, falcatis, pinnis infimis furcatis, 5–7 cm longis, segmentis contiguis, 4 mm latis, apice rotundatis et minute mucronatis, anguste cartilagineo-cinctis, subcoriaceis; venis inconspicuis, plerisque furcatis; soris sinu et apice sat remotis, indusio obscuro.

PALAWAN, *Bur. Sci. 662 Foxworthy,* anno 1906.

The specimen bears four quite uniform fronds; also, the frustrum of a longer and stronger stipe, indicating that larger fronds may be produced.

PTERIS MICRACANTHA Copel., sp nov.

P. paleis 3–4 mm longis, angustis, ebeneis marginibus ferrugineo-fibrosis; stipite 45 cm alto, valido, fusco-brunneo, sulcato, sursum imperfecte glabrescente; lamina 50 cm longa, apice subpinnata parva (5 cm longa), pinnis inferioribus biparibus bipinnatifidis, 20 cm longis, infimarum pinnulis utroque latere ca. 5, usque ad 9.5 cm longis et 2.5 cm latis, pinnis lateralibus suprabasalibus 11-paribus, contiguis, erecto-patentibus, breviter pedicellatis, acuminatis, ad alam 0.5 mm latam pectinatis, costa superne ad insertionem costulae quaeque spinam 0.5 mm longam gerente, segmentis ca. 3 mm latis, plerisque falcatis, integris, obtusis, coriaceis; venis et simplicibus parallelis et geminatis et furcatis; soris fere ad sinus et apices protensis, indusio 0.5 mm lato.

LUZON, Abra Province, *Bur. Sci. 7164 Ramos,* anno 1909.

PTERIS PEDICELLATA Copel., sp. nov. **Plate 8.**

P. paleis 5–6 mm longis, lanceolato-aciculatis, atrocastaneis; stipite ultrametrale, deorsum fuscencente sparsissime muriculato, sursum fulvo laeve; lamina ca. 1 m longa, parte terminale 20 cm longa cauda lineari 7 cm longa inclusa; pinnis lateralibus usque ad 20– paribus, stipitulatis, erecto patentibus, inferioribus 30 cm longis, 3–4 cm latis, valde caudatis, ad alam 0.4 mm latam pinnatifidis, segmentis ca. 4 mm latis, erecto-patentibus, obtusis, venis prope costulas furcatis, costis spinis validis concoloribus vix 1 mm longis munitis, costulis spinis minoribus gracilibus praeditis; pinnis infimis 35 cm longis, pinnulis ca. 3 basiscopicis ornatis; soris fere ad sinus et apices protensis.

LUZON, Cagayan Province, Mt. Tabuan, *Bur. Sci. 77206 Ramos,* type. Here probably belong also *Bur. For. 15913 Bacani,* from Benguet, and *Phil. Nat. Herb. 4725 Alcasid* and *Edaño,* from Quezon, also *Bur. Sci. 5794 Ramos,* from Benguet, with several pinnatifid pinnules on each side of the basal pinnae.

PTERIS RAMOSII Copel., sp. nov.

P. P. longipedi affinis coriacea; paleis 7 mm longis, brunneis, stipite 70 cm alto, sordide brunneo; lamina breviore tripartita; parte axiale bipinnatifida, pinnis brevissime pedicelatis, usque ad 8 cm longis, 13 mm latis, in caudas angustas 10–13 mm longas excurrentibus, costis superne ad insertiones costularum minute spinigeris, segmentis 3 mm latis, coriaceis, utroque latere costulae bullatis, apicibus sterilibus inconspicue dentatis vel subintegris, venis inferioribus furcatis; soris lateralibus, latis, nec ad sinus nec ad apices e longatis; pinnis basalibus ca. 25 cm longis bipinnatifidis.

LUZON, Abra Province, *Bur. Sci. 7161 Ramos,* anno 1909.

PTERIS RIGIDULA Copel., sp. nov. **Plate 9.**

P. rhizomate adscendente et basi castaneo stipitis paleis 5–9 mm longis atrocastaneis lineari-aciculatis pallide marginatis vestitis; stipitibus 30–60 cm altis, sursum stramineis; lamina ca. 30 cm longa, deltoidea, parte terminale 10 cm longa, 13 mm lata, acuminata vel subcaudata, ad alam 0.3 mm latam rhacheos pinnatisecta; pinnis lateralibus usque ad 11-paribus, sessilibus vel inferioribus subsessilibus, patentibus, usque ad 14 cm longis, 2 cm latis, brevicaudatis, segmentis 3 mm latis, coriaceis, costa spinulis parvis irregularibus munita; pinnis infimis 16 cm longis, usque ad 13 cm latis, utroque latere pinnulis 4–7 praeditis; soris sinu tantum interruptis, ad apices contiguis.

BATANES ISLANDS, Mt. Iraya, *Bur. Sci. 80132 Ramos,* type; also, *Bur. Sci. 3148, 3150 Mearns ex char.; Bur. Sci. 3564, 3650 Fenix,* and from Casiguran, on the N. E. coast of Luzon, *Bur. Sci. 3109 Mearns.*

PTERIS SQUAMIPES Copel., sp. nov. **Plate 10.**

P. stipite 35 cm longo, sulcato, brunneo-viride, basi paleis castaneis et atrocastaneis lanceolato-attenuatis 5–7 mm longis dense vestito, sursum paleis sparsioribus decrescentibus patentibus modo persistentibus ornato; lamina ca. 40 cm longa, rhachi deorsum minute paleata et puberula; parte terminale frondis 20 cm longa, 4 cm lata, caudata, basi decurrenti-cuneata; pinnis infimis brevi-stipitulatis, furcatis auricula fere 10 cm longa

brevi-caudata; pinnis lateralibus ca. 5-paribus, inferioribus subsessilibus, 12 cm longis, 3.5 cm latis, ad alam 0.6 mm latam pinnatisectis, segmentis 5.5 latis, minute mucronulatis, ob rigiditatem venarum furcatarum utraque facie praestantium firmis, costa inferne minute puberula, superne spinis 1 mm longis munita, costulis spinis minoribus pluribus praeditis, sinubus saepe denticulis minutis occultis; soris propius ad sinus quam ad apices protensis, indusio angusto.

MINDANAO, Butuan, *Weber 1163*.

The only Philippine species of this group bearing even slightly persistent conspicuous paleae above the base of the stipe.

OLEANDRA HERREI Copel., sp. nov. **Plate 11.**

O. nitidae similis; paleis appressis setiformibus 6 mm longis; pedicellis 6–7 mm longis, conspicue paleatis; lamina 25 cm longa, 22 mm lata, deorsum ad basin 5–7 mm latum angustata deinde truncata, inferne setulis paucis albis persistentibus praedita, costa paleis lanceolatis pallidis 1.5 mm longis onusta; soris fere costalibus, indusiis cordiformibus vel orbicularibus sinu angusto.

NEGROS, Cuernos de Negros, alt. 1,100 to 1,800 m, *Herre s.n.*, June, 1931, type; *Elmer 9959*. PANAY, Capiz Province, Mt. Bulilao, *Bur. Sci. 35643 Martelino* and *Edaño*.

Distinguished by freely paleate costa and truncate base.

OLEANDRA CLEMENSIAE Copel., sp. nov. **Plate 12.**

O. gregis O. colubrinae, paleis 3–4 mm longis castaneis setiformibus, nonnullis sparsissime ciliatis; pedicellis vix 1 mm longis; fronde sessile 50 cm longa, 2.5 cm lata, basi imo anguste rotundata, apice caudata cauda angustissima 3 cm longa conspicue ciliata, costa sat dense albo-setosa et paleis paucis inconspicuis praedita, lamina herbacea, ciliata, utraque facie pilulosa; soris irregulariter medialibus, indusiis parvis brunneis tenuibus.

LUZON, Isabela Province, Mt. Moises, on trunks in forest, *Clemens 16494*. Type in Herb. Univ. Calif. *No. 285480*.

Readily recognizable by the long conspicuously ciliate tails of the fronds.

NEPHROLEPIS PUBESCENS Copel., sp. nov.

N. foliis more generis ad caules stolones gerentes fasciculatis; stipitibus ca. 5 cm longis, rhachibusque paleis sparsis ferrugineis fibrillisque vestitis ; lamina 15–20 cm longa, 3 cm lata, pinnis infimis remotis reductis, caeteris imbricatis, sessilibus, acroscopice subauriculato-truncatis basiscopice angustius truncato-rotundatis, obtusis, argute serrulatis dentibus plus minus

callosis, inferne pubescentibus pilis simplicibus septatis minutis, nec carent omnino pila basi ramifera; soris submarginalibus, parvis, indusio integro reniforme vel semiorbiculare, oblique marginem versus aperto.

MINDANAO, Cotabato Province, *Bur. Sci. 11539 C. B. Robinson*, June, 1910.

In spite of the indusium with open sinus, the affinity is probably to the species or group called *N. hirsutula.* The very few laminar hairs with short basal branches indicate that the numerous simple hairs are derived from paleæ. Accordingly, I suppose that *DeVore* and *Hoover 357,* from Mt. Apo, is a larger form of this species. Its lamina is 25 cm long and 6.5 cm broad; the nether surface bearing pale, fibrillose paleae mixed with few simple hairs. In the peculiar margin and in the sori it is like Robinson's plant.

CYATHEA BREVILOBA Copel., sp. nov.

C. integrae affinis, major, stipite (infra pinnam remotam reductam infimam) 20 cm longo, paleis pallidis lanceolato-aciculatis ornato et dense furfuraceo, sursum rhachique glabrescentibus, inermibus; lamina 175 cm longa, 65 cm lata, utrinque angustata, bipinnata; pinna mediale 38 cm longa, 16 cm lata, brevi-pedicellata, rhachi sparse, minute et decidue squamulata, castanea; pinnulis 8 cm longis, 12 cm latis, inferioribus brevi-pedicellatis, subacuminatis, medio ad costam lobatis lobis vix 4 mm longis, basi 5 mm latis, oblique subacutis, integris vel obscure serrulatis, papyraceis, superne nigris nitidis inferne fusco-olivaceis, costis sparse squamuliferis, venis nudis, fertilibus furcatis; soris medialibus, magnis, indusiis mox fissis.

CATANDUANES, *Bur. Sci. 75660 Ramos* and *Edaño.*

CYATHEA DURA Copel., sp. nov.

C. stipite ob pinnas valde reductas inferiores subnullo; rhachi deorsum atropurpurea vix 1 cm crassa spinosa, sursum brunnea muriculata inferne glabrescente; fronde 105 cm longa, 35 cm lata, acuminata, deorsum longe attenuata; pinnis medialibus 25 cm longis, 10 cm latis, sessilibus, bipinnatifidis, rhachibus inferne muriculatis, superne setulis incurvis purpureo-nigris dense vestitis; pinnulis maximis 5 cm longis, 1 cm latis, apicibus serrulatis, sessilibus, profunde pinnatifidis, rhachillis costisque inferne sparse squamuliferis; segmentis 5 mm longis, 3 mm latis, obtusis, integris, brunnescentibus, rigide coriaceis; soris parvis, costalibus plerisque ad rhachillas approximatis ut videtur exindusiatis.

MINDANAO, Bukidnon Province, Mt. Lipa, *Bur. Sci. 38513 Ramos* and *Edaño;* type in U. S. Nat. Herb.

Like *C. ramosiana* in general aspect, but without conspicuous indusia, and with more deeply cut, rigid pinnules.

CYATHEA INDUSIOSA Copel., sp. nov.

C. rhachide castanea minute punctulata, superne paleis setiformibus 7–10 mm longis stramineis vestita, inferne, glabrescente; pinnis 40–45 cm longis, 15–18 cm latis, abrupte acuminatis breviter (vix 1 cm) stipitulatis, rhachidibus brunneis asperis, ubique furfuraceis squamulosisque, et praecipue deorsum paleis 4–7 mm longis anguste lanceolatis attenuatis stramineis brunneo-ciliatis ornatis; pinnulis ca. 9 cm longis, 2–2.5 cm latis, breviter acuminatis, sessilibus, parte tertia inferiore pinnatis, rhachillis inferne squamulis et bullatis et planis lanceolatis et ovatis ciliatis, fissis et integris dense vestitis; pinnulis secundariis sessilibus et adnatis, patentibus, 2.5 mm latis, obtusis, integris vel apicibus denticulatis, infimis interdum leviter lobatis, subcoriaceis, superne atroviridibus etiam inferne obscuris, costis deorsum squamulosis; venis ca. 10-paribus, inconspicuis; soris costalibus, indusio brunneo primo globoso, rupto et collapso diu persistente.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14855 Ramos.*

The conspicuous pale paleae on the secondary rachises are suggestive of the still lighter ones of *C. argyrolepis,* but the brown marginal hairs on *C. indusiosa* are crowded and weak, while those on *C. argyrolepis* are spaced and rigid. The near affinity is to *C. Loheri,* which is more completely tripinnate, and has the larger paleae entire or sparsely ciliate with whitish hairs.

CYATHEA SETULOSA Copel., sp. nov.

C. rhachi castanea sparse furfuracea, indumento minute fusco-ferrugineo, pinna mediale 45 cm longa, bipinnata, breviter acuminata, subsessile, rhachi dense furfuracea; pinnulis majoribus 9 cm longis, basi sessile interdum dilatatis 17 mm latis, breviter caudatis, in parte tertia vel media inferiore pinnatis, deinde pinnatifidis, subcoriaceis, superne nigrescentibus inferne fusco-viridibus, rhachillis inferne fusco-squamulosis; pinnulis secundariis resp. segmentis, 2–2.5 mm latis, apices subacutos versus obscure serrulatis, costis brunneo-squamulosis et furfuraceis; venis 9–11-paribus plerisque prope costam furcatis; soris costalibus, parvis, indusiis ferrugineis, fragmentis plus minus persistentibus.

LUZON, Quezon Province, Mt. Camatis, *Phil. Nat. Herb. 5068, 4565 Alcasid* and *Edaño.*

The specific name is inappropriate, but is retained because specimens may have been distributed under it.

CYATHEA ACUMINATA Copel., sp. nov.

C. ex parte mediale frondis describenda, rhachi castanea, gracile (5 mm crassa), spinulis rigidis persparsis asperata, glabrescente; pinna brevi-pedicellata, 70 cm longa, rhachi superne sulcata furfuracea, aliter ut rhachis frondis; pinnulis remotis, horizontalibus, usque ad 14 cm longis et 28 mm latis, in caudam longam argute etsi minute serratam attenuatis, inferioribus conspicue (4 mm) pedicellatis ad mediam longitudinem pinnatis deinde ad alam angustam pinnatifidis rhachillis parce ferrugineo-squamulosis; pinnulis secundariis infimis sessilibus sequentibus adnatis 15 mm longis 3.5 mm latis, acutis, inferioribus ⅔ ad costam incisis caeteris serratis lobis acutis parce serratis, superne atroviridibus inferne olivaceis, subcoriaceis; venis ca. 10-paribus, in lobis plerumque triramosis; soris inferioribus subcostalibus sequentibus costalibus, parvis (vix 1 mm diametro), indusiis laete ferrugineis, mox fissis fragmentis sat persistentibus.

PANAY, Capiz Province, Jamindan, *Bur. Sci. 30900 Ramos* and *Edaño.* Type in Herb. Univ. California.

CYATHEA LOBATA Copel., sp. nov. **Plate 13.**

C. rhachi asperula, laete castanea, inferne furfuracea, ad latera paleis linearibus brunneis 6 mm longis ornata; pinnis sessilibus, 35 cm longis, subacuminatis, rhachibus eae frondis similibus sed paleis lanceolatis ferrugineis hinc inde persistentibus vestitis; pinnulis subcontiguis, sessilibus, 6 cm longis, brevi-acuminatis, prope basin pinnatis, rhachillis paleis brunneis et ovatis et lanceolatis, apiculatis dense vestitis; segmentis 7 mm longis, 2.5 mm latis, obtusis, ubique inciso-lobatis, lobis plerisque emarginatis, subcoriaceis, superne atroviridibus etiam inferne obscuris, costis nisi apud rhachillam nudis; venis utrinque 6 vel 7, ad basin furcatis, soris costalibus, indusio brunneo persistente.

LUZON, Laguna Province, Mt. Banajao, *Bur. Sci. 19597 Ramos.*

Conspicuously scaly; distinguished from all other species by its inciso-lobate segments.

CYATHEA FERRUGINEOIDES Copel., sp. nov.

C. ferrugineae affinis, major, rhachibus ad latera et decidue inferne fibrillis 2–3 mm longis vestitis paleis ovatis carentibus

distincta; fronde ultrametrale, rhachi castanea inferne sublaeve; pinnis medialibus 30 cm longis, 15 cm latis, breviter (2 cm) stipitulatis, pinnis infimis minoribus; pinnulis inferioribus pedicellatis (2 mm), 8 cm longis, basi 2 cm latis, acuminatis, fere ad rhachillam pinnatisectis, superne nigris, harbaceis, rhachillis inferne paleis parvis angustis ferrugineis ornatis et plus minus furfuraceis; segmentis plerisque 3 mm latis, obtusis, infimis interdum latioribus et serrulatis, costis squamulis bullatis apiculatis ornatis; soris costalibus, parte basale indusii disrupti persistente.

PALAWAN, Mt. Capoas, *Merrill 9532*, April, 1913. Type in U. S. Nat. Herb.

CYATHEA CAMAGUINENSIS Copel., sp. nov.

C. rhachidibus brunneis, glabris, sparse et minute punctulatis; pinnis 55–60 cm longis, 15–17 cm latis, subsessilibus, abrupte acuminatis, bipinnatifidis; pinnulis ca. 9 cm longis, 14–16 mm latis, sessilibus, acuminatis, basi vix pinnatis, rhachillis parce et decidue squamuliferis; segmentis late patentibus, 3 mm latis, acutis, integris vel apicibus serrulatis, tenuiter subcoriaceis, superne atroviridibus etiam inferne obscuris, squamulis costarum paucis inter soros occultis; venis usque ad 10 utrinque; soris costalibus, multis, contiguis, indusio brunneo, fragmentis magnis diu persistentibus.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14828 Ramos.*

In general appearance much like *C. indusiosa*, apparently collected at the same place and time, but conspicuously different in the absence of paleae. Near to *C. callosa*, which is paler beneath and has narrower, more rounded segments, and less firm, more transient indusia.

CYATHEA LEPIDIGERA Copel., sp. nov.

C. fuliginosae similis, squamulis fere omnibus bullatis distincta; rhachi deorsum 1 cm crassa, spinulis multis 1–1.5 mm longis acutis nigrescentibus armata, brunnea, furfuracea; pinnis inferioribus decrescentibus deflexis et recurvis, non remotis; medialibus horizontalibus, 35–45 cm longis, subsessilibus, abrupte acuminatis, rhachibus brunneis muriculatis, inferne furfuraceis squamulis minutis brunneis plerisque amorphis; pinnulis sessilibus, 7–9 cm longis, subacuminatis, rhachillis inferne squamulis laete brunneis plerisque bullatis, saepe apiculatis, rarius ovatis et fere planis dense vestitis; segmentis infimis (rarius biparibus) liberis, caeteris confluentibus, ca. 7 mm longis, 2.5 mm latis, obtusis, late et leviter incisulis vel

fere integris, subcoriaceis, superne atroviridibus, inferne modo pallidioribus, costis squamulis multis plerisque bullatis vestitis; venis utrinque ca. 8, plerisque furcatis ramis late divaricatis; soris inframedialibus, exindusiatis.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14842 Ramos* type; also, *14859* and *14846*, the last the base of a smaller and more congested frond, probably from an exposed tree.

CYATHEA MASAPILIDENSIS Copel., sp. nov.

C. stipite spinis nigris 3 mm longis perhorrido; rhachi brunnea, inferne aspera, minute furfuracea vel glabrescente; pinna mediale pedicellata (2–3 cm), 50 cm longa, 16 cm lata, rhachi superne velutina, ad latera paleis angustissimis contortis castaneis usque ad 5 mm longis ornata, inferne furfuracea asperula; pinnulis omnibus pedicellatis pedicellis usque ad 7 mm longis dense setuliferis et paleis ciliatis basi paulo dilatatis deinde attenuatis vestitis; pinnulis 8 cm longis, basi 18 mm latis, apice subacuminatis, alibi profunde pinnatifidis, segmento infimo saepe libero; rhachillis deorsum squamuliferis et paleis paucis angustis castaneis praeditis; segmentis 3 mm latis, subfalcatis, apice rotundatis, subcoriaceis, superne atroviridibus, inferne paulo pallidioribus, costis paleis paucis deciduis sparsis, venis ca. 10–paribus; soris parvis costalibus, indusio brunneo squamiforme partem vix mediam costascopicam sori tegente.

LUZON, Bontoc Subprovince, Mt. Masapilid, *Bur. Sci. 37858 Ramos* and *Edaño*, type, in U. S. Nat. Herb.; also, *37899*, juvenile, providing the stipe.

Conspicuously distinguished from all neighboring species by the long-stalked pinnules.

CYATHEA ARGYROLEPIS Copel., sp. nov.

C. gregis C. lunulatae, trunco et stipite ignotis; rhachi 1 cm crassa, brunnea nuda, spinulis horrida; pinnis brevi-pedicellatis, 45–50 cm longis, breviter acuminatis, rhachibus inferne subdecidue glabrescentibus minute furfuraceis, ad latera paleis argenteis lanceolato-attenuatis 8–15 mm longis sparsis ornatis, spinulosis, marginibus minute brunneo-setuloso-ciliatis; pinnulis subsessilibus, 8–15 cm longis, sensim acuminatis, rhachillis deorsum paleis argenteis lanceolatis 3 mm longis ciliatis conspicuis obtectis, sursum paleis decrescentibus pilisque ornatis; segmentis infimis liberis caeteris confluentibus, 6–9 mm longis, 2.5–3 mm latis, subfalcatis, integris, acutis aut obtusis, subcoriaceis, superne atroviridibus, inferne modo pallidioribus, costis ubique albo-pilosis, deorsum etiam sparse bullato-squa-

mulosis; venis utrinque ca. 8; soris inframedialibus, indusiis invisis.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14843 Ramos.*

Distinguished from *C. lepifera* by the conspicuous, narrow, shining-white paleae. Judging by the single collection, the parts of the frond are somewhat dimorphic, the sterile pinnae, pinnules and segments being longer and broader than the fertile.

CYATHEA SULITII Copel., sp. nov.

C. C. fuligiosae similis, rhachillis costisque multo nudioribus distincta; parte inferiore stipitale rhacheos 60 cm longa, pinnis abortivis perpaucis valde remotis ornata, glabrescente, spinulis minutis dense armata; lamina vera 150 cm longa; pinnis medialibus 40 cm longis, 12 cm latis sessilibus, rhachillis superne fusco-velutinis, inferne glabrescentibus, muriculatis, ad latera pinnis paucis fuscis 3 mm longis donatis; pinnulis sessilibus, 7 cm longis, 17 mm latis, brevi-acuminatis, deorsum pinnatis, costis deorsum haud dense paleolatis, tuberculis nigris dense obsitis, paleis ovatis apiculatis fulvis; segmentis 3 mm latis, subacutis, ubique serratis, coriaceis, inferne pallidis, superne nigro-fuscis, nisi ad bases glabris; venis ca. 10–paribus; soris costalibus, exindusiatis.

LUZON, Mountain Province, Mt. Nangaoto, alt. 2,400 m. in oak forest, *Phil. Nat. Herb. 5089 M. D. Sulit.*

Sulit reports the trunk as 2 m tall, 12 cm in diameter.

An obvious relative of the locally common, densely paleate *C. fuliginosa.*

CYATHEA BREVIPES Copel., sp. nov.

C. C. Merrillii simillima; stipite 10 cm longo, atro-fusco, spinis 0.5–1.0 mm longis aspero, superne in sulca paleis piliformibus 1 cm longis fuscis congestis vestito; rhachi deorsum pinnis nonnullis proximis infimis 3 cm longis bipinnatifidis ornata, sursum brunnea, laeve, glabra; pinnis medialibus 50 cm longis, 14 cm latis, subsessilibus, acuminatis, rhacillis superne paleis paucis piliformibus vestitis, inferne glabrescentibus; pinnulis 7.5 cm longis, 17 mm latis, sessilibus acuminatis, ad alam nullibi carentem pinnatifidis, costis costulisque squamulis stramineis perpaucis adspersis vel nudis; segmentis 3 mm latis, subacutis, apices versus serratis, papyraceis, superne fusco-viridibus, inferne pallidioribus; venis ca. 10–paribus; soris costularibus, nec indusiis nec squamis inferioribus visis.

NEGROS, Negros Oriental Province, summit of Mt. Balinsasayao, alt. 976 m, *Phil. Nat. Herb. 5201 Edaño.*

In spite of great resemblance to *C. Merrillii,* I do not feel sure that the two species are near relatives.

A specimen from the same region, Inalacan River, alt. 500 m *Phil. Nat. Herb. 6214 Edaño,* is larger, coarser and more firm in texture. It may represent this or a similar species.

GYMNOSPHAERA DINAGATENSIS Copel., sp. nov. Plate 14.

G. gregis G. squamulatae fronde monomorpha, rhachi brunnea sursum purpurascente inferne fere glabra, pedicello pinnae conspicue circumcincto; pinna mediale 45 cm. longa, 14 cm lata, rhachi superne dense appresso-setulosa inferne glabrescente; pinnulis infimis paulo reductis, medialibus conspicue pedicellatis, 7 mm latis, subacuminatis, basi cordato-truncatis, basi tantum pinnatis; pinnulaii et segmentis sequentibus late oblongis, oblique subapiculatis, integris, subcoriaceis, costa inferne decidue squamulosa; venis inferrioribus saepe furcatis ceteris fertilibus simplicibus; soris subcostularibus.

Dinagat Island (Surigao Province), *Bur. Sci. 83453 Ramos* and *Convocar,* May to June, 1931.

However uniformly the tree-ferns used to be described from incomplete material, I do not like to continue the practice. However, the conspicuously stalked pinnules and round-oblong entire segments distinguish this from any species hitherto kown here or elsewhere.

POLYSTICHUM PULOGENSE Copel., sp. nov.

P. stipitibus confertis usque ad 30 cm longis, deorsum paleis nigris ferrugineo-marginatis ca. 1 cm longis 2–3 mm latis valde attenuatis immersis, sursum et paleis sparsis brevioribus fuscis et aliis fibrillosis pallidis et pilis stramineis vestitis; lamina usque ad 40 cm longa, acuminata, basi truncata, bipinnata, rhachi paleis parvis ferrugineis, ovatis, lanceolatis et linearibus et pilis, et deorsum paleis paucis ovatis fuscis onusta; pinnis haud contiguis, 5–7 cm longis, 13–18 mm latis, subsessilibus, basi truncatis, acutis; pinnulis liberis ca. 10–paribus, subsessilibus, imbricatis, late trapeziformibus, auriculatis, spinis multis horridis, vix aliter dentatis, subcoriaceis, facie inferiore fibrillosis; soris medialibus indusiis parvis fuscis brunneo-marginatis.

LUZON, Benguet Province, Mt. Pulog, alt. 2,600 to 2,800 m, terrestrial in mossy forest, *Copeland P. P. E. 162,* type, the

largest specimen; *Bur. For. 16254 Curran, Merritt* and *Zschokke,* the spiniest specimen; *Bur. Sci. 8813 McGregor,* all collected in 1909, and distributed as "*P. aculeatum* var."

POLYSTICHUM AQUILINUM Copel., sp. nov.

P. stipitibus confertis usque ad 45 cm longis, brunneis, deorsum paleis usque ad 15 mm longis, 3 mm latis, attenuatis plerisque nigris late ferrugineo-marginatis, rarius ubique nigris vestitis, sursum paleis et nigris et pallidis piliformibus et pilis sparsis; lamina 35 cm longa, acuminata, basi aut truncata aut saepius paullo angustata, rhachi paleis angustis et pilis nigris et ferrugineis obsita; pinnis haud contiguis, medialibus ca. 10 cm longis, 2 cm latis, subacuminatis; pinnulis contiguis, subauriculatis, acutis apice spinam brevem gerente, alibi aut argute serrulatis aut spinulis inconspicuis donatis, subcoriaceis, facie inferiore, fibrillis paucis modo deciduis praeditis; soris medialibus, indusiis brunneis persistentibus.

LUZON, Mountain Province, Mt. Data, alt. 2,100 m, terrestrial in mossy forest, *Copeland 1888,* type, October, 1905; also Pauai, *Copeland s. n.,* and *Bur. Sci. 8349 McGregor;* Mt. Ugo, *Bur. Sci. 5817 Ramos:* Zambales Province, *Bur. Sci. 4770, 5134 Ramos;* Mt. Canlaon, *Merrill 6927.*

A number of other collections from the Benguet region bear black paleae, but are doubtfully identical. Black or partly black paleae of course do not suffice to characterize a species in the group of *P. aculeatum*; they are found on various species, ranging from the Marquesas and New Zealand to the Himalayas; but I do not believe that they occur on any fern which ought to be known as *P. aculeatum* or *P. setiferum.*

POLYSTICHUM FUSCUM Copel., sp. nov.

P. stipitibus confertis 15–20 cm longis, basi paleis rubido-ferrugineis, 18 mm longis, 2 mm latis, aciculari-attenuatis immersis, sursum rhachique paleis anguste setiformibus rigidis 1–7 mm longis horridis; lamina 35–40 cm longa, acuminata, basi truncata, bipinnata; pinnis majoribus contiguis, 10 cm longis, 2 (usque ad 2.2) cm latis, acuminatis, brevissime stipitulatis, rhachillis setis et paleis stiformibus obsitis; pinnulis more gregis (P. aculeati) trapeziformibus, infimis acroscopicis incisis, caeteris fere integris, inconspicue auriculatis, apice rotundatis, margine spinis parvis praecicue apices versus multis donatis, coriaceis, superne atrofuscis glabris, inferne fuscis ad venulae fibrillosis; soris supramedialibus, indusiis late crenatis persistentibus.

LUZON, Abra Province, *Bur. Sci. 7167 Ramos,* January to February, 1909.

Well characterized by the many brown bristles of various size on stipe and rachises, and the absence of broader paleae except near the base. The smaller bristles are sometimes tufted, but the large ones are almost wholly destitute of basal branches.

POLYSTICHUM ELMERI Copel., sp. nov.

P. stipite 25–35 cm longo, ubique paleato, paleis fuscis basi imo plerisque lanceolatis 15 mm longis, sequentibus late ovatis vix 1 cm longis 6–7 mm latis apiculatis, sursum mixtis decrescentibus; lamina 75 cm longa, acuminata, rhachi indumento e paleis angustissimis deorsum 1 cm longis crinitis fuscis et nigrescentibus, paleis minoribus lanceolatis attenuatis fuscis et ferrugineis, et setis et fibrillis composito obtecta; pinnis medialibus recte patentibus 15–17 cm longis, protracto-acuminatis caudis argute inciso-serratis, 2.5–3 cm latis, brevi-pedicellatis, infimis ca. 9 cm longis deflexis; pinnulis more gregis (P. aculeati) trapeziformibus, brevissime pedicellatis, subauriculatis, supra auriculam 5 mm latis, contiguis vix imbricatis, subacutis, inciso-serratis dentibus mucronatis, herbaceis, superne obscure inferne pallide viridibus, fere glabris; soris parvis inframedialibus, indusio minuto crenato-lobato.

MINDANAO, Davao Province, Todaya, alt. 1,200 m, *Elmer 11802,* type; *Copeland 1031,* smaller and with fewer very broad paleae.

This may be *P. aculeatum* var. *subamoenum* Christ; being uncertain, I prefer not to adopt that name.

A related form, or more probably species, on Mt. Matutum, has narrower, remote, acute, more conspicuously incised pinnules. I have two specimens, but it has never been distributed and may remain undescribed and unnamed until better collected.

CYCLOPELTIS ZAMBOANGANA Copel., sp. nov.

C. preslianae affinis, paleis ciliatis et pinnis basi nec auriculatis nec imbricatis distincta; paleis 8–10 mm longis, atrocastaneis, anguste lineari-attenuatis, dentis minutis dense ciliatis; stipite 10–15 cm longo; lamina 60–70 cm longa, deorsum vix attenuata, pinnis infimis 7–8 cm longis; pinnis medialibus ca. 12 cm longis, 2 cm latis, subintegris, subacuminatis, basi acroscopice truncatis basiscopice plerisque cordatis non imbricatis.

MINDANAO, Zamboanga Province, San Ramon, on rocky hillsides in dry forest, alt. ca. 150 m, *Copeland s. n.,* November 27, 1904.

Sparsely ciliate paleae occur on some specimens of this genus from Sarawak. Typical *C. presliana* is also found at San Ramon.

BOLBITIS EDANYOI Copel., sp. nov. **Plate 15.**

B. gregis B. heteroclitae, fronde fertile simplice, sterile lineare cum pinnis uniparibus parvis basalibus ellipticis distincta; stipitibus paleis parvis adspersis, frondis sterilis ca. 7 cm, fertilis 20 cm longis; frondis sterilis laminae parte mediale 30 cm longa, 15–20 mm lata, longissime attenuata et sub apice prolifera, integra, subopaca, venatione B. heteroclitae, pinnis ad basin ipsum uniparibus, sessilibus, 2–3 cm longis, 10–13 mm latis, utrinque rotundatis; lamina fertile 3 cm longa, 5 mm lata, integra.

MINDANAO, Davao Province, on ridge in forest near Baguan River, alt. 1,525 m, *Phil. Nat. Herb. 8811 G. E. Edaño.*

Too distinct for specific inclusion in *B. heteroclita,* variable as that species is in the Philippines.

BOLBITIS FOXII Copel., sp. nov. **Plate 16.**

B. B. argutae affinis, pinnis sterilibus integrioribus, fertilibus integris distincta; stipitibus approximatis, frondium sterilium usque ad 15 cm longis, stramineis, glabris, frondis fertilis fere 30 cm longo; fronde sterile 30 cm longa, pinnis longe (1 cm) pedicellatis, erecto-patentibus, 5–7 cm longis 6–8 mm latis, acutis, basi cuneatis, remote serratis dentibus in sinubus plerumque carentibus, venatione obscura, laxa; fronde fertile 15 cm longa, pinnis foliolaque terminale integris, ca. 4 cm longis, 4 mm latis, apice rotundatis.

POLILLO ISLAND, Bordios, alt. 150 m, on rocks in streams, *Phil. Nat. Herb. 8904 R. B. Fox.*

EDANYOA Copel., genus novum.

Filix aspidiacea Bolbitide derivata, venulis omnino liberis distincta, frondibus difformibus, pinnatis, pinnis sterilibus majoribus iterum pinnatis symmetricis.

EDANYOA DIFFORMIS Copel., sp. nov. **Plate 17.**

E. rhizomate ca. 1 mm crasso, paleis clathratis ovatis irregulariter lobatis lobis argutis vestito; stipitibus frondis sterilis 4–20 mm, fertilis 6–10 cm longis; lamina sterile 4 cm longa, 15–20 mm lata, bipinnata, segmentis argute dentatis; lamina fertile 3–4 cm longa, 10–15 mm lata, pinnis infimis basi incisis, sequentibus apucis integris, ubique sporangiiferis.

NEGROS, Negros Oriental Province, Lake Balinsasayao, "along ridge in forested slope," *Phil. Nat. Herb. 5213 G. E. Edaño,* September, 1948.

The collection consists of two plants, each with one fertile and several sterile fronds.

The apparent immediate affinity is to *Bolbitis cuspidata* (Presl) Ching. The fertile fronds of the two species may be indistinguishable by the naked eye; but the veins of *B. cuspidata* seem always to anastomose, while those of *E. difformis* never do so. The sterile frond of *E. difformis* is more dissected than that of any *Bolbitis.* With extreme reduction in size of fronds, the veins of *B. cuspidata* may become free for want of space for a network, as I have noted in monographing the group,–Philip. Jour. Sci. 37 (1927) 366; but this is not characteristic of whole plants nor of well developed plants. Annulus of about 12 thickened cells.

In spite of apparent affinity, not merely to *Bolbitis* but specifically to a form of *B. cuspidata,* I treat the new plant as generically distinct, because its most conspicuous peculiarity, the free venation, is shared by *Egenolfia. Egenolfia* too may be a derivative of *Bolbitis,* but is only generically related to *B. cuspidata.*

LOMAGRAMMA PEDICELLATA Copel., sp. nov.

L. rhizomate 1 cm crasso, stipite frondis sterilis 12 cm longo, 6 mm crasso, squamoso, frondis fertilis 16 cm longo; fronde sterile 85 cm longa, rhachi brunnea ubique squamulosa, pinnis infimis paulo reductis; pinnis miximis 15 cm longis, 13 mm latis, breviter (1 mm) pedicellatis, basi subaequaliter truncatis, attenuato-acuminatis, apice subfalcatis vel rectis, integris, herbaceis, venis inconspicuis, costis squamulis bullatis plerisque attenuatis vestitis, facie inferiore laminis sparse squamulifera; fronde fertile 60–65 cm longa, pinnis pedicellatis (2 mm), 13 cm longis, 3.5 mm latis basi vix latioribus, ubique (costa excepta) fructiferis.

PALAWAN, Mt. Mantalingahan, Brooke's Point, alt. 1,200 m, on tree trunks on forest slopes, *Phil. Nat. Herb. 531 Edaño.*

Distinguished from:

L. lomarioides, by narrower sterile, and stalked fertile pinnae.

L. Brooksii, by scaliness.

L. Copelandii, by narrower and stalked pinnae.

In the same neighborhood, Edaño collected bathyphylls, likely to represent the same species, of the general character

of those of *L. Brooksii.* I would assume the specific identity of these bathyphylls and the fronds of the adult plant, if he had not collected also what appear to be transitional fronds between bathyphylls and sterile acrophylls, but apparently not of the same species.

CTENITIS MEARNSII Copel., sp. nov.

C. gregis *C. vilis,* major, pinnis pluribus ovatis bipinnatis vel rhachin versus subtripinnatis; stipitibus fasciculatis, 70 cm altis, ubique paleis setiformibus atrofuscis deorsum 5–10 mm longis obsitis; lamina 60 cm longa et lata, subcoriacea, brunnea, rhachibus omnibus paleis setiformibus etsi minutis praeditis, pinnis inferioribus pluribus ca. 30 cm longis et 15 cm latis, pinnulis[iii] paucis, adnatis, 2 mm latis, serrulatis, facie superiore pilis articulatis adspersa, aliter glabris; soris inframedialibus ut videtur costularibus, contiguis, indusiis parvis demum deciduis.

LUZON, Benguet Subprovince, Pauai, alt. 2,100 m, *Bur. Sci. 4216 Mearns,* type; Mt. Pulog *Bur. For. 16277 Curran, Merritt* and *Zschokke:* Sorsogon Province, Mt. Bulusan, alt. 2,400 m, *Copeland s. n. Bur. Sci. 8607 McGregor,* from Pauai is a small and imperfect specimen.

Distinguished from *C. vilis* and *C. aciculata* by size, dissection and texture, and separated from them by a wide altitudinal zone.

CTENITIS PALEOLATA Copel., sp. nov.

C. stipite 60 cm alto, castaneo, basi paleis rufo-castaneis linearibus attenuatis 12 mm longis dense immerso, sursum rhachique paleis decrescentibus ubique vestitis; lamina 45 cm longa deltoidea deorsum quadripinnatifida, herbacea, rhachibus omnibus minute paleatis, minoribus etiam pubescentibus; pinnis infimis suboppositis longe (3.5 cm) pedicellatis, 20 cm longis, pinnula infima basiscopica 8 cm, acroscopica 6 cm longis, pinnulis remotis, pinnulis secundae ordinis inferioribus 15 mm longis 5 mm latis in segmenta vix 1 mm lata acuta falcata fere ad costam pinnatisectis, venis puberulis, superficie glabra, venulis inferioribus angulo angustissimo furcatis; soris parvis, indusio inviso.

LUZON, Benguet Subprovince, Pauai, *Copeland s. n.,* May 9, 1913.

Well characterized by its very narrow pinnules and segments.

CTENITIS RAMOSII Copel., sp. nov.

C. rhizomate adscendente valido, apice paleis fuscis nitidis lanceolatis valde attenuatis 1 cm longis immerso; stipite 45–60

cm alto, atropurpureo, sparse paleato, rhachibusque pubescentibus; lamina 30–45 cm longa, 30 cm lata, herbacea, brunnea, basi subquadripinnata; pinnis remotis erecto-patentibus, pedicellatis, acutis vel brevi-acuminatis, pinnis basalibus oppositis, 20–25 cm longis, pinnulis infimis basiscopicis 10 cm longis 5 cm latis, pinnis secundariis plerisque adnatis, infimis liberis brevipedicellatis fere ad costas pinnatisectis, segmentis 3 mm latis, facie superiore pilis articulatis adspersa, inferiore glabra; soris medialibus vel supramedialibus, indusiis magnis, persistentibus, orbiculari-reniformibus.

SAMAR, Mt. Canislagan, alt. 300 m, *Bur. Sci. 17511 Ramos,* type, two sheets in Herb. E. B. C.; Catubig River, *Bur. Sci. 24758 Edaño.* BOHOL, Demyao, *Bur. Sci. 42981 Ramos.*

CTENITIS WENZELII Copel., sp. nov. **Plate 18.**

C. rhizomate breve adscendente; stipitibus contiguis, ca. 60 cm altis, atropurpureis, subnitidis, minute subdecidue puberulis, deorsum paleis fuscis lineari-lanceolatis 8 mm longis, ornatis; lamina 30–35 cm longa, deltoidea, acuminata, deorsum, subtripinnata, rhachi atropurpurea velutina; pinnis infimis valde remotis, suboppositis, 15 cm longis, 6 cm latis, pinnula basiscopica infima 6.5 cm longa, 1.5–2 cm lata, pedicellata, acuminata, ad alam angustissimam pinnatifida, segmentis 2–3 mm latis, costis superne velutinis inferne sparse piliferis, facie superiore glabrescente, inferiore sparse pilifera, brunnescente-viride, venulis furcatis liberis; soris medialibus, indusiis ut videtur carentibus.

LEYTE, *C. A. Wenzel 165,* June, 1913 (type in U. S. Nat. Herbarium.)

Obviously a near relative of *C. sagenioides.*

So far as Ching's key, Bull. Fan Bot. 8 (1938) 309, may serve as a guide, this might be his *Ctenitopsis kusukusensis,* but it is really very distinct in appearance, with remote and narrow pinnules and segments.

TECTARIA LOHERI Copel., sp. nov.

T. T. decurrenti affinis, ala stipitis angusta et breve, segmentis laminae multis haud remotis obtusis vel acutis, soris et indusiis parvis distincta; stipite 25–30 cm alto, paleis fuscis 5 mm longis lanceolatis et ovatis vestito, ala ca. 3 mm lata ad medium stipitem decurrente ornato; lamina 45 cm longa, basi 18 cm lata, rhachi ubique alata, segmentis 10–12-paribus, 2–3 cm latis, integris, superioribus pluribus in apicem coadunatis;

soris secus venas inconspicuas ordinatis, vix 1 mm latis, indusiis orbiculari-reniformibus.

LUZON, Rizal Province, Montalban, *Loher s. n.* type, May, 1915, in Herb. Univ. California; Sumag, *Loher s. n.*, May, 1914.

TECTARIA SULITII Copel., sp. nov.

T. inter T. crenatam (Cav.) et T. decurrentem (Presl); rhizomate ignoto: parte visa superiore stipitis 70 cm longa, castanea, paleis fuscis 6–10 mm longis lanceolatis distantibus ornata, sursum angustissime (1–2 mm) alata; lamina 110 cm alta, ad alam rhacheos pinnata, pinnis utroque latere 8, infimis furcatis, sequentibus usque ad 30 cm longis, 5 cm latis, valde acuminatis, integris vel undulatis, firme papyraceis, brunneo-viridibus, ala ca. 5 mm lata deorsum angustiore sursum modo latiore et soros gerente; venis conspicuis; soris stricte biseriatis, magnis, indusiis peltatis vel interdum orbiculari-reniformibus.

MINDANAO, Bukidnon Province, Mt. Katanglad, alt. 1,700 m, *Phil. Nat. Herb. 8727 M. D. Sulit.*

This plant has the color and texture of most specimens of *T. crenata,* but is distinguished by the uninterrupted wing of the rachis. *T. decurrens* is usually darker and thinner, with conspicuously broader wing of the rachis, and with stipe broadly winged almost to the base. A specimen from Camiguin de Mindanao, *Bur. Sci. 14836 Ramos,* may be *T. Sulitii,* but is too incomplete for certainty.

LASTREA CAVITENSIS Copel., sp. nov.

L. caudice parvo erecto. basibusque stipitum paleis fuscis 1–2 mm longis vestitis; stipitibus paucis fasciculatis, ad vestigia infima pinnarum 4–7 cm altis, stramineis, glabris; lamina 20–30 cm longa, 15 cm lata, breviter acuminata, deorsum angustata, rhachi superne dense setulosa inferne glabra, pinnis, infimis sensim ad vestigia 5 mm longa et lata reductis; pinnis medialibus 8 cm longis, sessilibus, basibus subtruncatis dilatatis vix 1 cm latis, deinde ad caudas integras attenuatis, medio ad costas incisis lobis obliquis 1.5 mm latis, herbaceis, costis minute setulosis, superficie superiore minutissime sparse setulosa; venulis 4–6-paribus, infimis ad sinus conniventibus rarius confluentibus; soris medialibus, indusiis nullis.

LUZON, Cavite Province, Mendez Nuñez, *Bur. Sci. 1302 Mangubat,* known by the one collection.

This collection was cited by Christ in the publication of *Dryopteris luzonica,* Philip. Jour. Sci. 2 (1907) Bot. 196. It is so clearly distinct from that species that mixture in collection

or distribution must be suspected. If an hybrid of *Cyclosorus luzonicus* and *Lastrea Foxii* be imagined, this might be it. The anastomoses of the lowest veinlets looks casual, as well as unusual.

CYCLOSORUS LEUCADENIUS Copel., sp. nov.

C. rhizomate inviso (verosimiliter breve et procumbente); stipite ad vestigia infima pinnarum 10 cm, ad pinnas normales 60 cm alto, 4–5 mm crasso, basi paleis paucis angustis 5 mm longis vestito, sursum rhachique costisque brevissime dense setulosis, rudimentis pinnarum ca. 15-paribus 5 mm longis latisque sed infimis ad vestigia callosa reductis; lamina 45–50 cm longa, 20 cm lata, basi truncata, foliola apicale 10 cm longa, pinnis sessilibus, basi truncatis vix dilatatis, acuminatis, 10 cm longis, ca. 13 mm latis, vix ¼ ad costam dentatis dentibus obtusis, subcoriaceis, utraque facie sparse et minutissime puberulis, glandulis globosis vel oblatis albis ubique ornatis; venulis 6–7-paribus 2 anastomosantibus; soris medialibus fere contiguis, indusiis deciduis ciliolatis, sporangiis parce setulosis.

LUZON, Benguet Subprovince, Baguio, *Elmer 8999,* distributed as *Dryopteris truncata.*

Nearest to the Philippine fern which I hesitantly call *C. subpubescens,* which has pinnae less truncate at base, and teeth so much coarser as to give it a very distinct appearance; also yellow or brownish glands, but this difference may be inconstant. Aerohpores subtending the lower pinnae can sometimes be detected, but are not conspicuous. The presumption that the rhizome is short and not erect is based on the curvature of the base of the stipe.

CYCLOSORUS RIGIDUS Copel., sp. nov. Plate 19.

C. rhizomate procumbente crasso, basique stipitis paleis angustis attenuatis atrocastaneis 6–8 mm longis haud densis vestitis; stipitibus contiguis, 25 cm altis, 3 mm crassis, brunneis, glabrescentibus; lamina 50 cm longa, acuminata, rhachi setosa, pinnis infimis paucis reductis, medialibus patentibus, 7 cm longis, 1 cm latis, sessilibus basi truncato-cuneatis non dilatatis, acuminatis, ⅓ ad costam inciso-serratis, rigide coriaceis, costis appresso-setosis, superne ad venulas setuliferis, inferne ubique sparse setuliferis; venulis ca. 6-paribus quarum 2 vel 2½ anastomosantibus; soris medialibus, indusiis persistentibus setosis.

LUZON, Benguet Subprovince, Mt. Ugo, *Bur. Sci. 5744 Ramos.*

At the base of the frond of the type, one pair of pinnae is reduced by one-third; the next pair is 2 cm long; then follow a foliar auricle, and two tubercles.

The affinity is uncertain; I let it follow the group of *C. dentatus,* but the texture is very distinct.

CYCLOSORUS IRAYENSIS Copel., sp. nov.

C. rhizomate repente, 5 mm crasso, apice basique stipitis paleis castaneis lanceolatis 2–3 mm longis protectis; stipitibus approximatis (non contiguis) usque ad 70 cm (saepius 35 cm) longis brunneis, glabrescentibus; lamina ca. 35 cm longa, apice pinnatifida acuminata, rhachi setulosa, pinnis infimis deflexis vix diminutis, inferioribus basim versus angustatis, caeteris basibus oblique truncatis, breviter pedicellatis, acuminatis, ad alam 2–3 mm latam pinnatifidis, lobis 3–4 mm latis oblique subacutis ciliatis, herbaceis, costis venisque et sparsissime venulis setulosis, faciebus glabris; venulis usque ad 12-paribus, infimis solummodo anastomosantibus; soris medialibus, indusiis parvis et inconspicuis, setulosis vel tantum ciliolatis.

BATAN ISLAND, Mt. Iraya, *Bur. Sci. 80344 Ramos,* type; also, *80156.*

CYCLOSORUS BENGUETENSIS Copel., sp. nov.

C. rhizomate ignoto; stipite 70 cm alto, basi paleis paucis laete brunneis lanceolatis 5 mm longis praedito, alibi setis pallidis velutino; lamina ultrametrale, foliola apicale 7 cm longa basi cm lata profunde pinnatifida acuminata, rhachi ubique densissime pubescente; pinnis modo remotis, inferioribus gradatim reductis infimis 3 cm longis hastatis, medialibus 13 cm longis 17 mm latis, erecto-patentibus, sessilibus, utroque latere hastulatis, in caudas serratas fertiles attenuatis, ad alam 2 mm latam costalem pinnatifidis, sinubus rotundatis, lobis ergo subremotis obtusis, subcoriaceis, ubique pallide strigosis; venulis 7–9-paribus, infimis anastomosantibus, sequentibus plerumque supra sinus ad marginem currentibus; soris medialibus, indusiis magnis persistentibus latericiis conspicue setosis.

LUZON, Benguet Subprovince, *Merrill 7679,* type: Ilocos Norte Province, *Bur. Sci. 32959 Ramos,* less setose than type.

Suggestive of the Indian *C. molliusculus* (Wall.) Ching, from which it is distinguished by much more rigid texture, denser coating of setae, rounded sinus, and conspicuous reddish-brown indusia.

CYCLOSORUS STENODONTUS Copel., sp. nov. **Plate 20.**

C. rhizomate inviso; stipite infra vestigia pinnarum breve, inconspicue setoso, laete brunneo; lamina 40 cm, vel partem

inferiorem ubi pinnae ad vestigia 3 mm longa remota gradatim decrescunt includente 70 cm longa, rhachi straminea pallide setosa, pinnis approximatis, sessilibus, 10 cm longis, basi subdilatato 15 mm latis, brevi-acuminatis, ⅗ ad costam lobatis lobis permultis basi 2 mm latis obtusis vel acutis, herbaceis, costa venisque superne conspicue inferne sparsius setosis, superficie superiore sparsissime setulosa inferne obscure glandulosa; venis ca. 8-paribus, infimis tantum anastomosantibus; soris parvis, medialibus, contiguis, exindusiatis.

PANAY, Capiz Province, Jamindan, *Bur. Sci. 30849 Ramos* and *Edaño,* April to May, 1918. Type in U. S. Nat. Herb.

One veinlet of the second pair usually runs to the sinus, but does not fuse with the excurrent secondary vein.

CYCLOSORUS SAGITTIFOLIOIDES Copel., sp. nov. Plate 21.

C. rhizomate et stipite invisis; frondis parte inferiore 35 cm vel ultra longa pinnis utroque latere 14 infima 8 mm suprema 3 cm longis nec remotis nec contiguis triangularibus basi truncatis vel subsagittatis ornata, rhachi avellana 8 mm crassa; lamina vera 75 cm longa, foliola apicale parva, pinnis infimis subdeflexis paullo diminutis, sequentibus patentibus 12 cm longis, sessilibus basi 2 cm latis, media longitudine 15 mm latis, ⅓ ad costam incisis dentibus subobliquis obtusis, apice acuminatis, herbaceis, venis venulisque utraque facie setosis setis faciei superioris perconspuis 1 mm longis, superficie superiore setulosis inferiore sparse glanduligeris; venulis 7-paribus quarum 1½ vel 2 anastomosantibus; soris medialibus, indusio parvo sporangia omnia nunquam tegente setuloso.

SAMAR, Catubig River, *Bur. Sci. 24832 Edaño.* Type in U. S. Nat. Herb.

Near to *C. sagittifolius* of Java; distinct in that the long series of reduced basal pinnae are not really sagittate and imbricate, nor quite contiguous, while those of the Javan species are sagittate and imbricate; also, the upper surface is conspicuously setulose, while that of *C. sagittifollius* is very sparsely and minutely when at all so. Of Philippine species, the most similar are *C. productus,* smaller and with relatively inconspicuous reduced lower pinnae; and *C. todayensis,* with falcate acute teeth, and lowest reduced pinnae remote. The stem is unknown, but the long series of decrescent basal pinnae strongly indicates an erect caudex.

CYCLOSORUS HALCONENSIS Copel., sp. nov.

C. C. sagittifolioidei similis et affinis, major et setis longis venarum carens; rhizomate et basi apiceque frondis ignotis;

lamina ultrametrale; pinnis medialibus ultra 20 cm longis, 2 cm latis, medio ad costam incisis, venis superne setis 0.5 mm longis sparsis, superficie superiore setis viz minoribus multis ornata; venulis anastomosantibus plerumque 1-paribus, rarius 1½-paribus; aliter vix ab C. sagittifolioidei distinctus.

MINDORO, Mt. Halcon, Dulangan River, along stream in forest, alt. 166 m, *Phil. Nat. Herb. 3849 Edaño.*

Distinguished from *C. sagittifolioides* by stature, and most conspicuously by the absence of many and long setae on the upper surface of the veins and veinlets. In spite of the size, the number of veinlets on the more ample pinnae and segments is fairly constantly 7 pairs. Another related species is *C. mindanaensis* (Christ) Copel., with much less conspicuously setose upper surface.

CYCLOSORUS ERECTUS Copel., sp. nov. **Plate 22.**

C. caudice erecto, gracile, parte apicale visa 1 dm longa 1 cm crassa, apice paleis atrofuscis 2–3 mm longis vestito; stipite 45 cm alto, brunneo, sparse et decidue paleato, subdecidue pubescente, vestigiis remotis aut foliosis minutis aut callosis pinnarum praedito; lamina 50 cm longa, ovata, apice pinnatifido caudato-acuminato 11 cm longo, rhachi dense breviter setosa, pinnis inferioribus 3-paribus insigniter deflexis et infimis medio brevioribus, medialibus oppositis recte patentibus, contiguis, 12 cm longis, 3 cm latis, subsessilibus et aerophoris parvis nigris sustensis, basi truncatis, angustissime acuminatis, ⅗ ad costas pinnatifidis lobis 5 mm latis rotundatis, subcoriaceis, brunneo-viridibus, costis et venis utraque facie setosis, superficie glabra, venulis ca. 12-paribus quarum 2 vel 2½ anastomosantibus; soris medialibus, inferioribus saepe oblongis caeteris orbicularibus, indusium interdum asymmetrico, microscopice setuloso.

LEYTE, Cabalian, *Bur. Sci. 41550 Ramos.* Type is U. S. Nat. Herb.

In color, texture and general aspect, this species suggests *C. heterocarpus* and *Lastrea crassifolia.*

CYCLOSORUS MAGNUS Copel., sp. nov.

C. rhizomate ignoto; stipite usque ad tubercula infima 10 cm ad pinnas normales 85 cm alto, brunneo, sparse fibrilloso, tuberculis callosis ca. 10 utroque latere praedito; lamina ultrametrale, basi truncata, foliola apicale parva, rhachi setosa, pinnis medialibus 20 cm longis, 2–2.5 cm latis, sessilibus, aerophoris vix conspicuis, subtruncatis, acuminatis, ⅗ ad

costam lobatis lobis acutis integris, papyraceis, utraque facie parce pubescentibus, costis superne appresso-setosis inferne glabrioribus; venulis 8–9–paribus quarum 2 anastomosantibus; soris medialibus, parvis, indusio glabro, persistente.

NEGROS, Mt. Canlaon, *Merrill 6952.*

A relative of *C. heterocarpus* and *C. Bordenii,* far larger, and, in correlation with its stature, having more anastomosing veinlets.

CYCLOSORUS BOHOLENSIS Copel., sp. nov. **Plate 23.**

C. gregis C. Arbusculae dense fructigerus pinnis profundius serratis basi utrinque dilatatis; caudice erecto 15 cm alto 1 cm crasso ob bases stipitum erectos adspectu crassiore; stipitibus dense fasciculatis, usque vestigia infima pinnarum brevissimis; fronde stipite incluso usque ad 1 m alta, 14 cm lata, utrinque angustata, apice pinnatifida 5 cm longa, pinnis inferioribus sensim diminutis 10–15-paribus infimis varié amorphis, medialibus patentibus approximatis sessilibus, basi utrinque plerisque subhastulatis, 7 cm longis, supra basim 8 mm latis, acutis, ⅓ ad costam inciso-serratis dentibus acutis angustis, subcoriaceis, rhachi strigosa, costis venisque et minutius venulis utraque facie setosis; venulis ca. 7-paribus, quorum prerumque 2 anastomosantibus; soris ca. 6-paribus, contiguis et paginam complentibus, indusio parvo setoso mox inter sporangia occulto.

BOHOL, Bilar, alt. 600 m. along stream in open brush and grass land, *Bur. Sci. 42990 Ramos.* Type in Herb. Univ. Calif.

CYCLOSORUS DUPLOSETOSUS Copel., sp. nov.

Species C. pilosiusculo (Racib.) C. Chr. affinis, minor, setis permultis arcte appressis congruens, setis aliis maximis praestantibus adspersis distincta; rhizomate brevi-repente, ad apicem paleis late lanceolatis fuscis 2.5 mm longis immerso; stipitibus contiguis, ca. 7 cm longis, setosis; lamina 10–13 cm longa, 4–5 cm lata, acuminata, basi truncata, rhachi dense pallide setosa; pinnis infra apicem pinnatifidam frondis 6–10-paribus, infimis deflexis subpedicellatis, caeteris sessilibus patentibus, obtusis, basi basiscopice late rotundatis acroscopice truncatis et subauriculatis, alibi ca. 5 mm latis, majoribus ⅓ ad costam inciso-serratis, costa utraque et venis inferne setosis, superficie superiore setis parvis appressis occulta et setis sparsis usque ad 1 mm longis ad venas venulasque ornata, herbacea; venulis 2–3 paribus, infimis anastomosantibus, sequentibus vix sinus

conniventibus; soris medialibus, indusiis setulosis, sporangiis nudis.

PALAWAN, Mt. Capoas, alt. 700 m, in open places on ridges in forest, *Merrill 9530,* type. *Bur. Sci. 9455 Robinson,* from Infanta, Quezon Province, is identical except for fewer and rather broader pinnae.

With regard to *C. pilosiusculus,* the name originating with Zippelius on a specimen in Buitenzorg, provided with a description by Raciborski, it may be observed that the same name on another specimen in Herb. Lugd. Bat. is the basis of *Aspidium pilosiusculum* Mett. The two are not at all the same, but are confused by Backer and Posthumus, Varenflora voor Java, p. 65.

CYCLOSORUS AORISTISORUS (Harr.) Copel.

Polypodium aoristisorum HARR., Jour. Linn. Soc. Bot. 16 (1877) 30.

Steere's collection, described by Harrington, consisted of a few old fronds, which had lost the indusia and a large part of the sporangia. Isotypes are in the U. S. Nat. Herb. and the Herbarium of the University of Michigan. Except by its imperfections, it is undistinguishable from Bolster's Surigao collection.

Mountains of PANAY, the type. MINDANAO, Surigao Province, Cansuran, alt. 80 m along stream, *Bolster 327:* Agusan Province, *Merrill 7328;* Mt. Urdaneta, *Elmer 14026,* alt. 900 m.

These specimens have been distributed as *Lastraea exigua* J. Smith, *Dryopteris philippina* (Presl) C. Chr. *non Lastraea philippina* Presl; the name adopted now being *Lastrea nervosa. C. aoristisorus* differs from that species, as it is known to me, in having some of its veinlets anastomosing, and in having comparatively persistent indusia. The two are quite certainly very nearly related. The proper genus is not certain.

The synonymy of this group of species is complicated, particularly by apparent mixtures under Cuming's collection numbers. In publishing *Lastrea exigua* as a *nomen nudum,* Smith, Journal of Botany 3 (1841) 412, cited two Cuming numbers, 251 and 272. Presl. Epim. (1849) 24, detected two species under no. 251, and described one of them as *Physematium philippinum.* I can identify this with reasonable probability, but the specific name can not be used for it in *Lastrea*; for this reason, it requires no further discussion.

The next name published was *Phegopteris nervosa* Fée, which can be recognized positively with the help of Fée's illustration, Mém. VI, *pl. 2, fig. 4.*

Mettenius, *Phegopteris* and *Aspidium* No. 180 (1858) 360, validated the specific name *exiguum* by publishing, with description, *Aspidium exiguum,* recognizing two varieties, a and b. By to-day's standards these are to be regarded as two species, and var. a should be the one to bear his name. But Mettenius cited *P. nervosa* Fée as a synonym of var. a, treating Smith's publication as valid. By our present rules, it is invalid; *P. nervosa,* as the earlier properly published name, has priority. In Philip. Jour. Sci. § C **6** (1911) 146, treating these ferns as *Dryopteris,* I could not use *nervosa* as the specific name, and had to adopt *exigua.* Now, in *Lastrea, nervosa* is revived, and *exigua* becomes the synonym.

Mettenius' var. b, evidently including at least a part of *L. exigua* J. Smith, seemed to be without a name, and I described it as *Dryopteris confusa,* typified by *Cuming 251* in the Phil. Nat. Herb. (then Herb. Bur. Sci.), citing also *Bur. Sci. 8271 Ramos.* Specimens of *Cuming 251* and *272* in the Philippines herbarium served me at that time. They no longer exist, and the confusion has been such that they may not be interpreted with confidence by specimens bearing the same numbers in other herbaria.

I now amend my treatment of 1911, by distinguishing the Mindanao plant then regarded as Mettenius' var. b. Whether or not it is like *Cuming 272,* it is distinguished by having many of the lowest veinlets anastomosing, and by fairly persistent setulose indusia. By its venation, it might be placed in *Lastrea,* regarding the anastomoses as casual, or in *Cyclosorus,* regarding them as characteristic; calling it *Cyclosorus aoristisorus,* I have adopted the latter alternative.

It can hardly be doubted that *C. aoristisorus* is related, on the one hand, to *Lastrea nervosa* and *L. confusa,* and, on the other, to *Cyclosorus urdanetensis* and *C. matutumensis.* These five species belong in one genus. As I now imagine their phylogeny, *L. nervosa* and *L. confusa* are derived from *Cyclosorus,* by simplification of the venation with loss of size, and consequent loss of anastomoses. If this be so, they should be treated as *Cyclosorus,* ancestry taking precedence of any diagnostic characteristic. But I am not so confident that I imagine the phylogeny correctly as to be ready to complicate the generic definitions by including in *Cyclosorus* species with all veins free.

CYCLOSORUS LOBATUS Copel., sp. nov.

C. rhizomate breve adscendente; stipitibus contiguis, frondium sterilium 15–20 cm, fertilium usque ad 60 cm altis, basi

paleis paucis 2 mm longis vestitis, alibi glabrescentibus; lamina usque ad 50 cm longa, rhachi superne setis incurvis castaneis dense obsita inferne decidue pubescente, foliola apicale ca. 7 cm longa, acuminata, pinnatifida, pinnis infimis plerisque deflexis vix abbreviatis basi angustatis, lateralibus ca. 10-paribus sessilibus basi acroscopice truncatis basiscopice late cuneatis, infra apices abrupte angustatis, 1.5–2 cm latis, ⅔ ad costas pinnatifidis, lobis multis ca. 2.5 mm latis, costis superne appresso-setosis inferne sparse setulosis, lamina utraque facie glabra; veni ca. 7–paribus, simplicibus, infimis tantum anastomosantibus; soris medialibus, indusio glabro.

LUZON, Benguet Subprovince, Baguio, alt. 1,400 m, in moist gulch, *Copeland 1966*, type: Rizal Province, *Bur. Sci. 1786 Ramos*.

The type of this species was named by Christ, Philip. Jour. Sci. § C 2 (1907) 198, as *Dryopteris canescens* var. *lobatum*, citing my collection number as *1866*, in error; but his description is so completely inappropriate to my specimen that it is safer now to provide an independent description than to transfer his name.

This species has much the gross aspect of a tall *C. diversilobus*, but is distinct in relative nakedness of all parts except the upper side of the rachis, in narrower lobes and simple veinlets, and in other details.

CYCLOSORUS GLABER Copel., sp. nov.

C. rhizomate inviso, verosimiliter procumbente; stipite perlongo, basi 1 cm crasso, usque basim imum aerophoris callosis conspicuis praedito, spinulis sparsis acutis aspero, aliter glabro, castaneo, nitido; lamina, 20 cm longa, apice pinnatifida 8 cm longa acuminatissima, basi truncata, ubique glaberrima, pinnis latetudine ipsarum remotis, majoribus 25 cm longis 16 mm latis, erecto-patentibus, sessilibus, basi basiscopico truncatis acroscopico late cuneatis, aerophoris callosis conspicuis subtensis, acuminato-attenuatis, ⅓ ad costam inciso-serratis dentibus oblique acutis, subcoriaceis, atroviridibus nitibus inferne olivaceis, venulis ca. 8-paribus quarum 2½–3 anastomosantibus; soris plerumque 6-paribus, medialibus, indusiis carentibus.

BOHOL, along Sevilla River, alt. 300 m, *Bur. Sci. 42976 Ramos*. Type in Herb. Univ. Calif.

Along with its great size, far over 2 m tall, distinguished by dark color and complete nakedness, conspicuous aerophores, and spinulose stipe. Each prickle probably marks the place of a caducous palea. Although 75 cm of the stipe is preserved, a long intermediate section is missing.

CYCLOSORUS VIRIDIS Copel., sp. nov. **Plate 24.**

C. C. glabro similis eocumque stipite spinoso ubique calloso et pinnis glabris longissime attenuatis usque ad apices serratis congruens, stipitibus gracilioribus plumbeis, lamina viride haud obscura et pinnis grossius incisis lobis argute apiculatis distinctus; stipite 35–65 cm alto, 5 mm crasso; lamina 60–85 cm longa; pinnis usque ad 25 cm longis, 22 mm latis, ⅔ ad costam incisis dentibus 5 mm latis e basi ad apicem mucronatum angustatis interdum serrulatis, venulis ca. 9–paribus quarum 2–3 anastomosantibus; indusio vestigiale glabro.

LUZON, Kalinga Subprovince, Lubuangan, Mt. Masingit, *Bur. Sci. 37490 Ramos* and *Edaño*, type in U. S. Nat. Herb.: Benguet Subprovince, Baguio, *Topping 206*, on shady bank.

Certainly near to *C. glaber*, but quite distinct in appearance, because of the color, the broader pinnae, and the broad, obliquely triangular teeth.

Topping 214, from Baguio, "along bank of stream," but not said to be shaded, is apparently this species, but congested, with strongly falcate teeth only 3 mm broad at base.

CYCLOSORUS SAMARENSIS Copel., sp. nov.

C. rhizomate repente, 2 mm crasso, paleis parvis ovatis vestito; stipitibus approximatis, frondium sterilium 3–5 cm, fertilium 8–16 cm altis, glabrescentibus; frondibus subdimorphis, sterilibus 5–8 cm longis, anguste ovatis, pinnatis, rhachibus setuliferis, foliola apicale lanceolata, acuta, quam lateralibus duplo longiore, basi modo incisa alibi integra, pinnis ca 5–paribus, subcontiguis, pedicellatis, 2–3 cm longis, 7 mm latis, obtusis, basi truncatis acroscopice subhastatis, herbaceis, superne glabris, inferne costis venis et marginibus minute setiferis; venis anastomosantibus seriem unam areolarum regularium et alteram irregularium includentibus; frondium fertilium pinnis remotis, 1 cm longis, oblongis, rotundatis; soris utroque latere costae uniseriatis vel rarius imperfecte biseriatis, exindusiatis, sporangiis setulis minutissimis munitis.

SAMAR, Matuguinao, alt. 60 m, on rocky creek-bank, *Phil. Nat. Herb. 15240 Gachalian* (type), *Phil. Nat. Herb. 1520 Gachalian*, a dwarf; Mt. Purog, alt. 80 m, *Phil. Nat. Herb. 15179 Edaño*, typical.

C. samarensis is a local representative of the polymorphic *C. rhomus*, see Philip. Jour. Sci. **56** (1935) 102, *pl. 6*. It is distinguished by pinnae broadest at or near the base.

CYCLOSORUS SERRATUS Copel., sp. nov.

C. rhizomate breve, adscendente, apice basique stipitis paleis castaneis lineari-aciculatis setulosis 1 cm longis dense immersis; stipite 20–35 cm alto, rudimentis foliosis remotis oppositis pinnarum ca. 6–paribus ornato, sursum rhachique minute setosis; lamina 35 cm longa, foliola apicale pinnis lateralibus simile, basi truncata, pinnis 15–25-paribus, inferioribus oppositis, sessilibus, 10–13 cm longis, 7–9 mm latis, basi late cuneatis, acuminatis, serratis dentibus latis truncato-appressis, firme herbaceis, ciliolatis, costis et minutissime venis setulosis, aliter glabris; venulis 4–5-paribus, quarum 2 anastomosantibus; soris medialibus, indusio aut glabro aut setulis paucis minutis subdecidius praedito.

LUZON, Bataan Province, flood-swept bank of Lamao River alt. 100 m, *Copeland Pterid. Philip. Exsic. 19,* type, ibid., *Copeland 224, 225; Whitford 108, 371; Merrill 931, 2554; Williams 29; Topping 407, 840.* Manila, *Merrill 8046;* Batangas Province, Santo Tomas, *Bur. Sci. 13742 Ramos,* larger than type, and teeth more salient.

My fragment of *Cuming 10* approaches this species and so far as shown is identical. That number may have been a mixture. Formally, it should typify *Nephrodium philippinense* Baker, and *Dryopteris basilaris* Christ; but both descriptions apply rather to the species described first by Presl as *N. nitidulum* based on *Cuming sine num.* and later by Mettenius as *Aspidium laeve,* based on *Cuming 33 bis ex parte,*–a citation which demonstrates the impracticability of relying on the numbers which Cuming himself did not apply to his collections. Under *D. basilaris,* Christ cited specimens of *C. serratus,* so that I might have adopted his name; but he avowedly redescribed *N. philippinense,* and I could never have been sure of its typification.

CYCLOSORUS WEBERI Copel., sp. nov. Plate 25.

C. rhizomate adscendente valido; stipite (usque ad pinnas normales) 30 cm alto, brunneo, basi imo paleis linearibus 1 cm longis vestito, sursum decidue setuloso, vestigiis pinnarum deorsum callosis sursum minutis foliaceis donato; lamina 60 cm longa, rhachi minute velutina, pinnis haud remotis, infimis, (normalibus) et medialibus similibus, patentibus, 20 cm longis, 15 mm latis, sessilibus et ad rhachin annulo circumdatis, basi acroscopico cuneato-truncato basiscopico rotundato-truncato, apicem versus acuminatum integris, alibi ¼ ad costam serratodenta-

tis, coriaceis, brunneis, costis superne minute et inferne microscopice setulosis, aliter glabris; venulis ca. 5-paribus quarum 2–3 anastomosantibus; soris medialibus, indusio persistente, glabro.

MINDANAO, Agusan Province, Butuan, *Weber 1174*, March to April, 1911. Type in U. S. Nat. Herb.

This was distributed as *Dryopteris basilaris* C. Chr., resembling *C. serratus* rather than *C. nitidulus;* easily distinguished by color and texture.

The name *Dryopteris Weberi* has been used, but for a *Lastrea*, for the species properly called *L. dichrotrichoides.*

CYCLOSORUS EDANYOI Copel., sp. nov.

C. rhizomate brevi-repente, paleis paucis minutis; stipitibus contiguis, 20–30 cm altis, 1.5 mm crassis, plumbeo-stramineis, glabrescentibus; lamina ca. 20 cm longa, ovata, rhachi brevi-setosa, foliola apicale 10 cm longa pinnatifida, pinnis utroque latere ca. 6, pedicellis 2 mm longis gracilibus, pinnis infimis nec reductis nec deflexis, plerisque 7 cm longis, 2 cm latis, ellipticolanceolatis, basi truncatis et acroscopice conspicue hastatis, ad apicem integrum contractis, oblique et supra mediam pinnam profundius inciso-serratis, subcoriaceis, glabris; venulis 7–9-paribus, plerisque anastomosantibus; soris medialibus, indusiatis.

PANAY, Capiz Province, Mt. Ditana, *Bur. Sci. 46065 Edaño.* Type in Herb. Univ. Calif.

The specimen is a single plant with four fronds. Its sori are too immature for complete description. The shape of the pinnae, somewhat abruptly contracted below the apex, suggests *C. diversilobus,* but I doubt any near affinity. The texture is rather that of *C. granulosus.*

CYCLOSORUS PUSTULOSUS Copel., sp. nov.

C. rhizomate brevi-repente, paleis paucis minutis (2 mm longis); stipitibus subcontiguis, usque ad 85 cm altis, stramineis vel laete brunneis, nisi in sulca mox glabris; lamina plerumque quam stipite breviore, foliola apicale lateralibus simile, pinnis infimis typice nec deflexis nec diminutis, pinnis ca. 7-paribus, alternantibus, usque ad 30 cm longis et 4.5 cm latis, plerisque sessilibus, basi subtruncatis, valde acuminatis, integris vel subcrenulatis, papyraceis, minute pustulosis, rhachi costis et venis setis pallidis brevibus praeditis, superficie inferiore minutissime setulosis; venulis usque ad 13-paribus, inconspicuis, obliquis, plerisque curvis, vena secundaria continua; soris medialibus, indusio parvo, retoso, sporangiis setuliferis.

LUZON, Bataan Province, Lamao River, *Copeland 218*, type; *ibid., Topping 427, Williams 215:* Bulacan Province, *Bur. Sci. 34049 Ramos* and *Edaño:* Rizal Province, *Bur. Sci. 964 Ramos.* MINDORO, *Merrill 997.*

This is "*Dryopteris urophylla* var. *pustulosa* Copel. MSS pro specie" of Christ, Philip. Jour. Sci. § C 2 (1907) 205; also, *D. glandulosa* Christ *ibid. partim,* but not *C. glandulosus* (Blume) Ching; also *Abacopteris truncata* Fée, Genera 310, as I have surmised without seeing an isotype; and Christ cites *Cuming 298* as *D. glandulosa.* Fée's name can not be transferred to *Cyclosorus.*

CYCLOSORUS SUBDIMORPHUS Copel., sp. nov.

C. gregis C. granulosi (Presl), *C. lineati* (Blume) et *C. latifolii* (Presl), rhizomate repente laxe et decidue paleolato; stipitibus ca. 30 cm longis glabrescentibus; lamina sterile ca. 15 cm longa, pinnata, rhachi dense setifera, pinnis 1-3-paribus, 7-10 cm longis, 2 cm latis, sessilibus, basi truncatis haud auriculatis, supra basin paullo dilatatis, acuminatis, serratis, herbaceis, minute setuliferis deinde glabrescentibus, costis sparse setiferis, venulis 5-6-paribus, anastomosantibus vel in dentibus liberis, foliola terminale latiore; lamina fertile minore, pinnis 2-5-paribus, soris exindusiatis, tum demum confluentibus, sporangiis setuliferis.

PALAWAN, Tarateon River, alt. 83 m, *Philip. Nat. Herb. 13925 Edaño,* March 5, 1951. Here belongs approximately *Bur. Sci. 77955 Edaño* on the Tigaplan River, Palawan, in 1929.

C. latifolius is larger, with more congested fronds, with more and broader, more entire, subhastate pinnae. *C. lineatus* should have more numerous pinnae and transient indusia; my material justifies the statement that *C. subdimorphus* is completely exindusiate. *C. granulosus* has approximate stipes, more pinnae, stalked if well developed, usually entire; as I construe it, including *Dryopteris chamaeotaria* Christ and *D. maquilingensis* Copel., this is the most variable species of the group.

ATHYRIUM IRIGENSE Copel., sp. nov.

A. gregis A. umbrosi, lamina ca. 90 cm longa, basi 75 cm lata, tripinnata, rhachi castanea glabra; pinnis remotis, alternantibus, acuminatis, basi truncatis, pedicellis inferiarum ca. 1 cm longis; pinnulis 7 cm longis, 1.5–2 cm latis, acuminatis, basi truncatis brevipedicellatis; pinnulis[ii] infimis liberis, sequentibus ala decurrente confluentibus, 3–5 mm latis, apice rotundatis,

inferioribus medio ad costulam incisis, sequentibus serratis, tenuiter herbaceis, glabris; venulis furcatis; soris costularibus, brevibus, oblongis, nudis.

LUZON, Camarines Province, Mt. Iriga, *Bur. Sci. 22189 Ramos*, December, 1913.

Characterized by fine dissection, thinness, and absense of indusium. The sorus does not extend beyond the forking of the veinlet. Rhizome and stipe are unknown.

ATHYRIUM IRAYENSE Copel., sp. nov.

A. stipite (parte visa 40 cm longa) rhachique brunneis, mollibus, glabratis; lamina 90 cm longa, ovata, tripinnatifida, apice acuta tantum pinnatifida; pinnis remotis, inferioribus longe (1 cm) pedicellatis non reductis, alternantibus, adscendentibus; pinnulis ca. 9 cm longis, 25 mm latis, vix contiguis, brevissime (1 mm) pedicellatis, acutis, basi truncatis, deorsum ¾ ad costam pinnatifidis, costis inferne paleis 1 mm longis ovatis integris fuscis sparissime donatis; lobis late oblongis, 6 mm latis, rotundatis, herbaceis, glabris; venulis plerisque furcatis; soris costularibus, 1–2 mm longis, indusio angusto, fragile.

BATAN ISLAND, Mt. Iraya, alt. 700 m "in slope of mossy forest," *Bur. Sci. 80153 Ramos.*

Apparently remotely related to *A. platyphyllum*, but not very near to any known Philippine species.

Batan Island is between Luzon and Formosa. From the latter island, where *Athyrium* is phenomenally rich in species, I have one specimen, *Faurie 182*, from Mt. Urai, which is near enough to *A. irayense* to be regarded as identical.

ATHYRIUM MAGNIFICUM Copel., sp. nov. **Plate 26.**

A. rhizomate erecto tum demum subarboreo, apice basibusque stipitum confertorum paleis lineari-acicularibus 1 cm longis aterrimis marginibus sparse spinulosis immersis; stipitibus usque ad 1 m longis, gracilibus, basi nigris alibi aut nigris aut fuscis aut brunneis, sursum glabrescentibus; lamina usque ad 2 m longa (teste Elmer), ovata, subtripinnata, pinnis alternantibus brevipedicellatis (1–2 cm), usque ad 50 cm longis, acuminatis; pinnulis subcontiguis, subsessilibus, 10 cm longis, basi 23 mm latis, acuminatis, ad alam angustam costae pinnatisectis, segmentis oblique positis, 3–4 mm latis vel infimis latioribus, argute serratis, apice rotundatis, herbaceis, glabris; venulis simplicibus remotis; soris costulis plerumque remotis et ad venulas inferiores saepe carentibus, indusiis angustis, persistentibus, brunneis, integris.

NEGROS, Negros Oriental Province, Cuernos de Negros, alt. 800 m, *Elmer 9626*, type, "Caudex erect, 15 cm high, half as thick. Stipes 1 m long"; *ibidem, Elmer 10010*, "Fronds 1–2 m long, pinnae rather soft in texture." MINDANAO, Camiguin, *Bur. Sci. 14873 Ramos;* Davao Province, Mt. Apo, *Elmer 10788;* Lanao Province, Camp Keithley, *Mrs. Clemens 111* and *s. n.*, "fronds 5 feet": Zamboanga Province, San Ramon, *Copeland 734, 1573, Merrill 5463.*

The foregoing specimens represent one species, characterized by great size, thin texture, almost tripinnate fronds, simple veins, conspicuous discrete brown sori, and a mass of narrow, jet-black, shining paleae. I have twice seen it with the stem up to a meter in height.

ATHYRIUM MELANOPODIUM Fée

A. melanopodium FÉE, Mém. 8^{me} (1857) 337 (?).

This is a Luzon fern, related to *A. magnificum*, but not nearly so large, the pinnules usually about 5 cm long, pinnatifid at most ¾ of the way to the costa, with close denticulate segments. The two are alike in the characteristic paleae, texture, and distinct remote sori. It is possible that they represent one species; but if so, it is wonderfully various in development.

Specimens in hand are *Cuming 159; Bur. Sci. 1090 Ramos*, and *Bartlett 14331*, from Rizal Province; *Vanoverbergh 2431*, from Bontoc: *McGregor 141*, Baco River, Mindoro, the last with a new unpublished name by Christ. I seem to have distributed, as *P. P. E. 240*, what may be a small form of it, as *Athyrium maquilingense*, but this is not in my own herbarium.

This is a part of *Athyrium meyenianum* as I construed that species, Philip. Jour. Sci. § C 3 (1908) 295. But Hieronymus, Hedwigia 59 (1917) 337, with a fragment of the type of *Diplazium meyenianum*, and the type of *Asplenium aspidioides* Goldm., based on the same collection, in hand, has stated positively that this is no Philippine fern, but is the Hawaiian species later described as *Diplazium Arnottii* Brack. Skottsberg, Acta Gotenburg. 15 (1942) 108, confirms this interpretation, and I feel obliged to accept it. Meyen collected at Jalajala, where our plant was surely to be found.

Cuming 159, at least in most herbaria, is *Diplazium caudatum* J. Sm., Jour. Bot. 3 (1841) 408; C. Chr., Suppl. III (1934) 72, *nomen nudum*. In publishing this name, Smith cited *Cuming 158*, but is said to have reversed nos. 158 and 159. Even this is not perfectly clear, as I have a sheet of "Cuming 158" which

is a mixture, in part *D. caudatum,* with that name attached to one component, which is doubtfully like my sheet of No. 159. The confusion is so complete that we may be glad that *D. caudatum* is a *nomen nudum,* and may henceforth be ignored. Hooker, Sp. Fil. III 257, 258, cited both *Cuming 158* and *159* under *Asplenium polypodioides* Mett., which should be my *Athyrium Blumei.*

I am not positive that my identification of *A. melanopodium* is correct. Fée's description is of a small plant, lamina about 40 cm long, pinnae 11 to 12 cm long and 6 cm wide, with crenate pinnules, "base du rachis brusquement nigrescent et dilaté." The description is incomplete, but the name is appropriate, and can apply to this rather than to any other Philippine species. The cited type is *Cuming 29,* but again there is "évidemment une erreur d'étiquette."

ATHYRIUM PARVUM Copel., sp. nov.

A. rhizomate adscendente, radicibus validis nigris et basibus stipitum immerso; stipite ca. 1 cm alto, gracile, sordido, nigrescente, paleis lanceolatis 2 mm longis minutissime denticulatis atrocastaneis deciduis ornato; lamina elliptica, 5 cm longa. 16–20 mm lata, integra, apice obtusa vel rotundata, basi subcordata, papyracea, glabra; venis plerisque bis furcatis venulis late divergentibus, angulo saepe recto anastomosantibus; soris brevibus ultra anastomoses non protractis, indusiis primo laete brunneis.

CATANDUANES, *Bur. Sci. 75652 Ramos* and *Edaño;* type. LUZON, Laguna Province, *Bur. For. 19264 Curran.*

Probably for want of another name, the type collection was distributed as *A. cordifolium.* From dwarfed individuals of that species, it differs in being a rosette-former, the numerous uniform fronds being broadly expanded. *A. cordifolium* has also more or less caudate fronds, longer and less-blackish stipes, and veins anastomosing at an acute angle.

ATHYRIUM SYMMETRICUM Copel., sp. nov.

A. A banajaoensi affine pinnis fere symmetricis, rhizomate erecto; stipitibus congestis. usque ad 18 cm altis, nigris, paleis linearibus 2–3 mm longis fuscis plerisque contortis basi dense sursum sparse vestitis; lamina usque ad 30 cm alta, 7 cm lata, pinnata apice pinnatifida, pedicellis pinnarum 1–1. 4 mm longis; pinnis fere contiguis, basalibus vix remotis, deflexis, paullo minoribus, medialibus ellipticis, 1–1.5 cm latis, obtusis, herbaceis, glabris, basi utrinque truncatis, profunde lobabis. Pin-

narum inferiorum segmentis infimis acroscopicis plerumque liberis (pinnulis); soris a costa remotis, rarius ultra 1 mm longis, angustis, indusiis brunneis integris.

SAMAR, Mt. Kabayanan, alt. 120 m, *Phil. Nat. Herb. 15148 Edaño;* Mt. Purog, alt. 250 m, *Phil. Nat. Herb. 15211 Edaño;* and alt. 450 m, *Phil. Nat. Herb. 15160 Edaño,* a smaller plant with less nearly symmetrical pinnae.

GONIOPHLEBIUM INTEGRUM Copel., sp. nov.

G. subauriculato affine, pinnis angustioribus plerisque integris; rhizomate 3–5 mm crasso, paleis laete brunneis 4–10 mm longis basibus parvis conspicue laceris apicibus longe setiformibus persistentibus vestito; stipite 20–30 cm longo, rhachique decidue furfuraceis; lamina usque ad 75 cm longa, pinnis multis linearibus plerisque integris acuminatis basibus plerisque utroque latere dilatatis, costis glabrescentibus, alibi glabris, areolis magnis uniserialibus, aliis parvis hinc inde inclusis; soris immersis, paraphysibus multis ovatis profunde dissectis rarius subpeltatis.

LUZON, Benguet Subprovince, *Merrill 7814,* type; also *Elmer 6375* from Baguio, and *Mearns 4202* from Pauai. The Baguio collection was identified by Christ as *Polypodium subauriculatum* forma *integra.*

MICROSORIUM RIZALENSE (Merr.) Copel., sp. nov.

Polypodium rizalense MERR., in herb.

M. gregis M. Scolopendriae, frondibus simplicibus breviter stipitatis sorisque fere superficialibus distinctum; rhizomate late repente, 1–1.4 mm crasso, basibus obscuris rotundis vel ellipticis palearum vestito; stipitibus remotis, 6–10 mm longis gracilibus, ad rhizoma articulatis (phyllopodiis carentibus); lamina 7–9 cm longa, medio 17–22 mm lata, acuminata, basi cuneata vix decurrente, (sicca) coriacea, brunneo-virente, venis inconspicuis; soris in seriem unam utroque latere costae fere medialem instructis, 2 mm latis, levissime impressis.

LUZON, Rizal Province, Mt. Lumutan, *Bur. Sci. 29648 Ramos* and *Edaño.* Type in U. S. Nat. Herbarium.

Simple fronds on *M. Scolopendria* are not rare. They are common on a strain in the southern Philippines and Borneo. The related *M. acutifolium* of New Guinea and the Admiralties has them uniformly simple. From these exceptional fronds and species, *M. rizalense* is well distinguished by slender rhizome and stipes, short stipes, distinct frond form, and almost superficial sori.

PYRROSIA PHILIPPINENSIS Copel., sp. nov.

Polypodium samarense METT., Pol. (1857) 123, *pl. 3, figs. 1–4; non Gyrosorium samarense* PRESL, the source of the name.
Cyclophorus samarensis C. CHR., Index (1905) 200, *partim.*
Pyrrosia samarensis CHING, Bull. Chinese Bot. Soc. **1** (1935) 49.

P. rhizomate late repente, basibus ellipticis nigro-brunneis palearum obtecto; fronde late lineare, sursum fertile et plus minus contracta, soris utroque latere costae uniseriatis superficialibus, magnis, oblongis et contiguis vel confluentibus.

LUZON, Laguna Province, type: *Philippine Plants 946 Ramos,* (type) August, 1910, distributed by the Bureau of Science as *Cyclophorus angustatus.*

I publish this as in form a new species, in order to provide a definite type with widely distributed isotypes believed to be uniform.

CRYPSINUS RAMOSII Copel., sp. nov.

C. rhizomate repente 2 mm crasso, paleis brunneis lanceolato-ovatis 5 mm longis basi 2 mm latis apice setaceis vestito; stipitibus 8 cm longis, gracilibus, brunneis; lamina 1 dm. longa, fertile 12–15 mm, sterile 2 cm lata, subcoriacea, margine anguste cartilagineo incisulis raris, venis primariis inconspicuis venulis obscurioribus; soris inter venas solitariis, inframedialibus, superficialibus.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14825 Ramos,* March to April, 1912.

CRYPSINUS SUBDIMORPHUS Copel., sp. nov.

C. rhizomate latissime repente, 1 mm crasso, paleis 6 mm longis ferrugineis supra basin peltatis et ibidem 0.6 mm latis, deinde attenuatis vestito; stipitibus remotis, filiformibus, 6–7 cm longis; lamina sterile 5–9 cm longa, supra basin 2–2.5 cm lata, basi late cuneata, sursum ad apicem acutum sensim angustata, subcoriacea, margine crenato-incisula angustissime cartilaginea, venis primariis fere ad marginem manifestis, venulis occultis; lamina fertile usque ad 13 cm longa et 9 mm lata, soris utroque latere costae uniseriatis, superficialibus, magnis, orbicularibus, annulo 14–cellulare, sporis reniformibus, echinulatis.

LUZON, Laguna Province, Mt. Maquiling, alt. 1,000 m, *Copeland s. n.,* 1934.

Somewhat similar to *C. rhynchophyllus,* but with filiform stipes, and thinner fronds peculiar in being abruptly cuneate below the broadest portion. Some affinity to *C. lagunensis* is suspected. Occasional fronds are intermediate between the typically fertile and sterile.

SELLIGUEA MATUTUMENSIS Copel., sp. nov.

S. rhizomate late repente, 2 mm crasso, paleis sordide brunneis appressis orbiculari-ovatis 3–4 mm longis, apice rotundatis vel rarius acutis vestito; stipite gracile, frondis sterilis 7–11 cm, fertilis 15 cm longa; lamina sterile usque ad 11 cm longa, vix 4 cm lata, obtusa, basi breviter cuneata, coriacea, margine cartilagineo conspicue incisulo; venis primariis praestantibus, venatione aliter omnino occulta, lamina fertile 1 cm lata, coenosoris 2 mm longis late ellipticis.

MINDANAO, Mt. Matutum, alt. 1,800 m, *Copeland s. n.*

Known by a single specimen. It belongs in the group of *S. Feei,* but the paleae suggest those of *S. brachylepidota,* of New Guinea.

ACROSORUS SYMMETRICUS Copel., sp. nov.

A. rhizomate breve erecto, paleis ferrugineis anguste lanceolatis integris occultis vestito; stipitibus subnullis confertissimis; lamina 15 cm longa, 5–6 mm lata, deorsum in alam sinuatam stipitis sensim angustata, alibi profunde pinnatifida, parte media superiore fertile, costa nigra glabra; segmentis sterilibus patentibus 2 mm latis, late rotundatis lateribus parallelis, coriaceis; segmentis fertilibus fere aequilongis, paullo angustioribus, costam versus haud angustatis.

NEGROS, summit of Mt. Malbug, alt. 840 m, *Phil. Nat. Herb. 5951 G. E. Edaño.*

All other species of *Acrosorus* have sterile segments more or less obliquely triangular. The most similar species is the Bornean *A. streptophyllus, Polypodium streptophyllum* Baker, Jour. Bot. **17** (1879) 42.

CTENOPTERIS MICROPORA Copel., sp. nov.

C. adspectu Prosaptiae alatae, rhizomate brevi-repente, 4 mm crasso, paleis 4–5 mm longis fuscis valde attenuatis conspicue ciliatis immerso; stipitibus approximatis, 1–2 cm longis, setulis castaneis 0.3 mm longis dense obsitis; lamina 35 cm longa, 4.5 cm lata, acuta, deorsum modo angustata, coriacea, superne glabrescente, inferne setis sparsis diutius perditis ornata, ad alam 2 mm latam pinnatifida, rhachi praecipue deorsum setosa, segmentis e basi ad apicem angustatis medio 3 mm latis, ciliatis setis interdum binatis; soris parvis usque ad 11-paribus sed haud contiguis, fere marginalibus, profunde immersis, oribus crat-rum planis.

MINDANAO, Mt. Matutum, alt. 900 m, *Copeland s. n.,* May 2, 1917: Lanao Province, Camp Keithley, *M. S. Clemens 1217:* Agusan Province, Mt. Urdaneta, alt. 1,500 m, *Elmer 13832.*

This seems to be the plant reported from Mt. Kinabalu, Borneo, as *Polypodium khasyanum.* From real *Ctenopteris khasyana, P. khasyanum* Hooker, Icones Pl. (1854) *pl. 949,* it differs in having the hairs on the stipe only one-third as long, in being distinctly stipitate, being less deeply pinnatified with more numerous and entire segments, not fleshy, and with far more numerous sori.

CTENOPTERIS MATUTUMENSIS Copel., sp. nov.

C. mollicomae affinis, frondibus latioribus et pinnis deorsum lobato-crenatis distincta; stipitibus 2 cm longis, 1 mm crassis, setis obscure cinnamomeis 2 mm longis densissime obtectis; lamina 15 cm longa, 4.5 cm lata, deorsum pinnata, sursum subpinnata, pinnis infimis modo remotis et reductis, medialibus 4 mm latis rhachin versus basiscopice leviter acroscopice conspicue lobato-crenatis, apices versus integrescentibus; soris utroque latere costae usque ad 12; aliter simul ac C. mollicoma.

MINDANAO, Mt. Matutum, alt. 2,000 m, *Copeland s. n.,* May, 1917.

VITTARIA HECISTOPHYLLA Copel., sp. nov.

V. nana, rhizomate breve, paleis brunneis 1–2 mm longis basi 0.3–0.5 mm latis, aristatis, integris; frondibus fasciculatis, 3–6 cm longis, 1 mm latis, obtusis, deorsum ad rhizoma angustatis, rigidis; soris vero intramarginalibus, sed ob angustatem laminea paginam totam fere complentibus, ad apicem fere basimque frondis protensis non interruptis, paraphysibus anguste turbinatis.

MINDANAO, Cotabato Province, Guinatilan, alt. 800 m, "in very wet woods," *Copeland s. n.*

The type consists of two plants, one with three fronds at most 6 cm long, the other with six congested fronds at most 3 cm long, all in remarkably full fruit. One must be reluctant to describe as new a plant characterized most conspicuously by minuteness. But, in this case, the uniform presence of long sori testifies to its maturity, and its occurrence" in very wet woods," imbedded in moss, *Hepaticae,* and the usual mass of wet-forest debris, shows that the environment can hardly be responsible for dwarfing.

ILLUSTRATIONS

[All are photographs and drawings of the types].

PLATE 1.

FIG. 1. *Microtrichomanes zamboanganum* Copel. x 4.
2. *Pteris Edanyoi* Copel. x 5.
3. *Pteris Loheri* Copel. x 8.

PLATE 2. *Dennstaedtia MacGregori* Copel.
PLATE 3. *Dennstaedtia fusca* Copel.
PLATE 4. *Lindsaea angusta* Copel.
PLATE 5. *Lindsaea decrescens* Copel.
PLATE 6. *Pteris MacGregori* Copel.
PLATE 7. *Pteris mucronulata* Copel.
PLATE 8. *Pteris pedicellata* Copel.
PLATE 9. *Pteris rigidula* Copel.
PLATE 10. *Pteris squamipes* Copel.
PLATE 11. *Oleandra Herrei* Copel.
PLATE 12. *Oleandra Clemensiae* Copel.
PLATE 13. *Cyathea lobata* Copel.
PLATE 14. *Gymnosphaera dinagatensis* Copel.
PLATE 15. *Bolbitis Edanyoi* Copel.
PLATE 16. *Bolbitis Foxii* Copel.
PLATE 17. *Edanyoa difformis* Copel. n. gen. et sp. Part of type, x 2.
PLATE 18. *Ctenitis Wenzelii* Copel.
PLATE 19. *Cyclosorus rigidus* Copel.
PLATE 20. Cyclosorus stenodontus Copel.
PLATE 21. *Cyclosorus sagittifolius* Copel.
PLATE 22. *Cyclosorus erectus* Copel.
PLATE 23. *Cyclosorus boholensis* Copel.
PLATE 24. *Cyclosorus viridis* Copel.
PLATE 25. *Cyclosorus Weberi* Copel.
PLATE 26. *Athyrium magnificum* Copel.

1

2

3

PLATE 1.

PLATE 2.

PLATE 3.

PLATE 4.

PLATE 5.

PLATE 6.

PLATE 7.

PLATE 8.

PLATE 9.

PLATE 10.

PLATE 11.

PLATE 12.

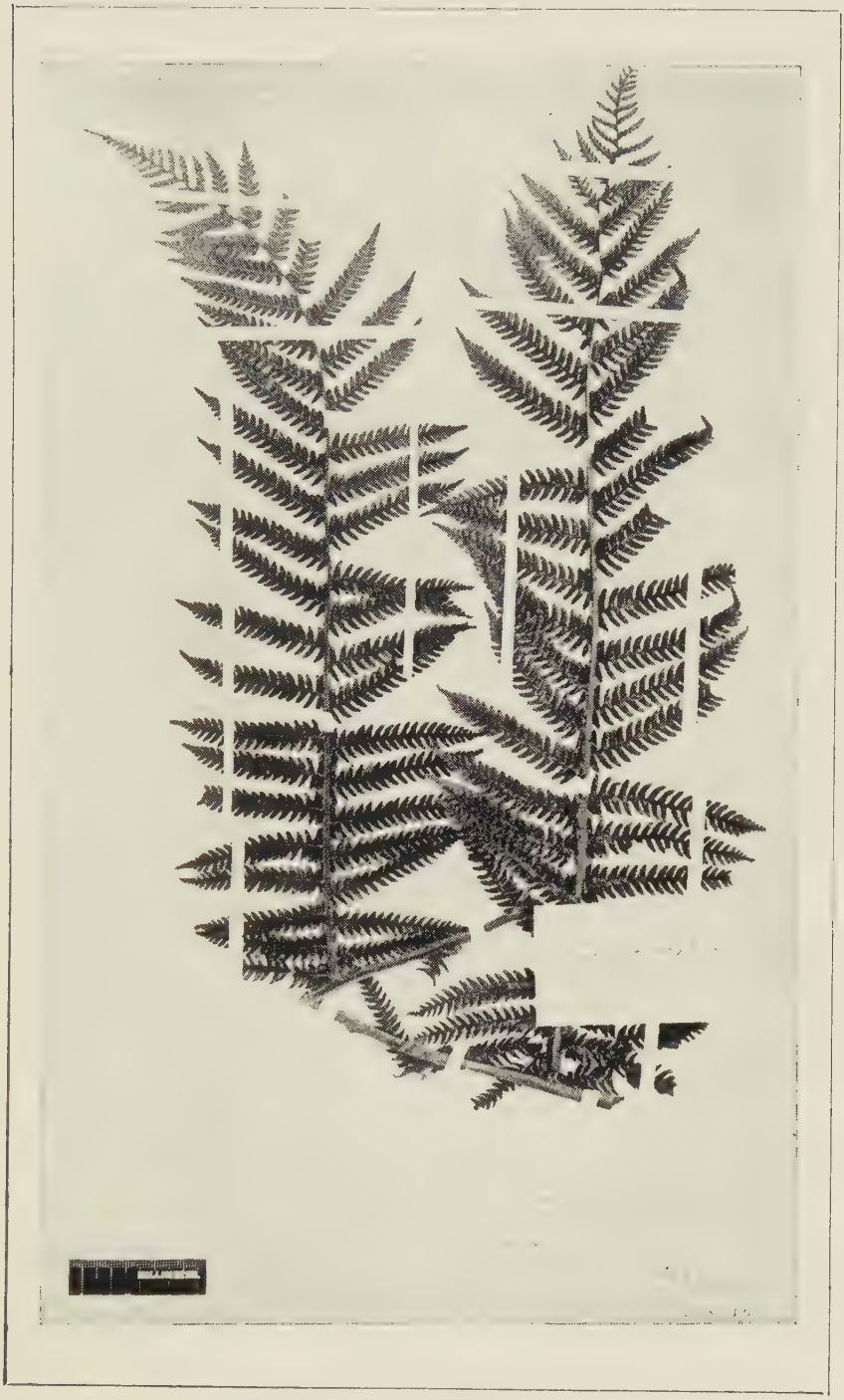

PLATE 13.

PLATE 14.

PLATE 15.

PLATE 16.

PLATE 17.

PLATE 18.

PLATE 19.

Cyclosorus stenokoulus Copel
FLORA OF THE PHILI
PROVINCE
PANAY

PLATE 20.

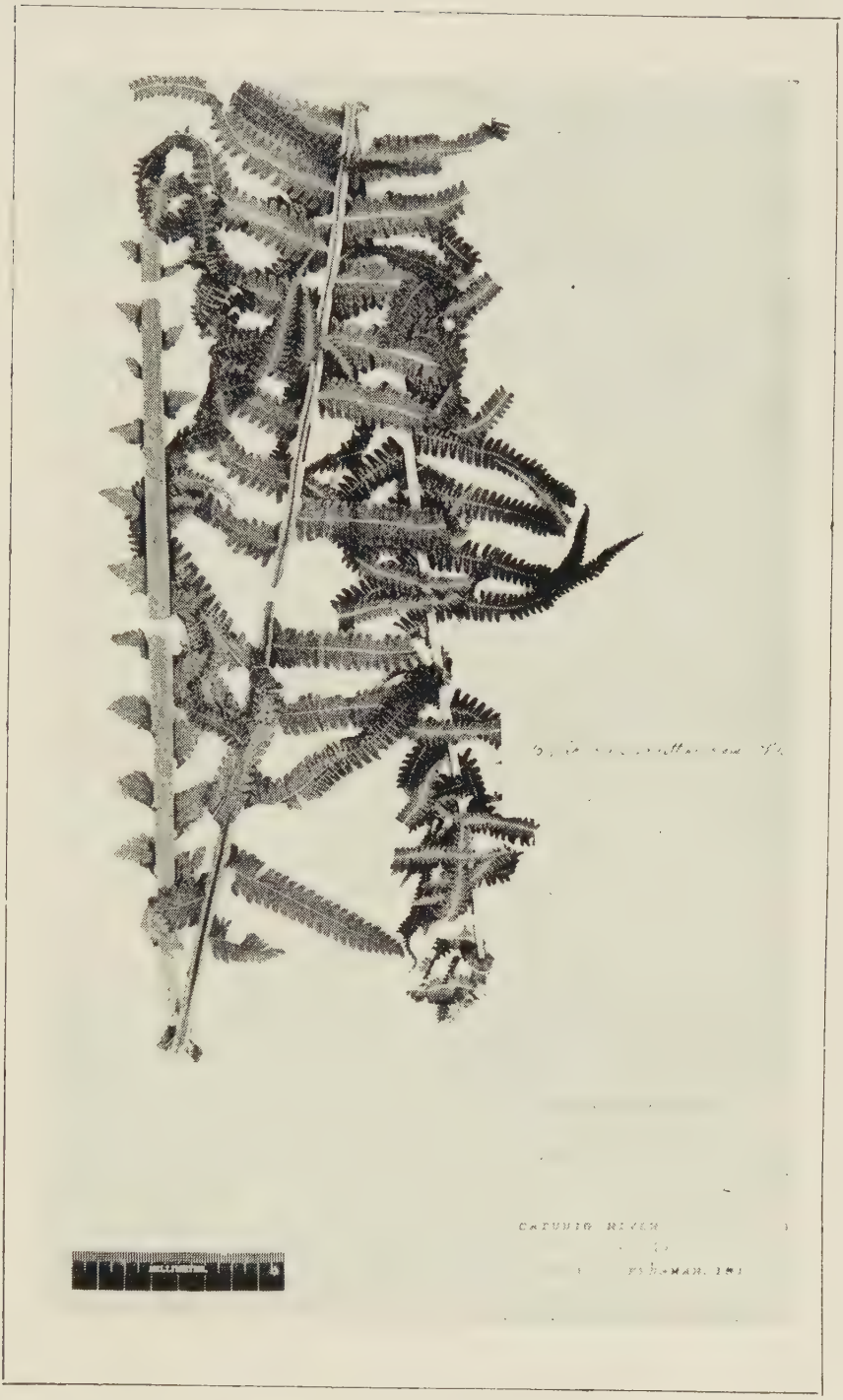

PLATE 21.

PLATE 22.

PLATE 23.

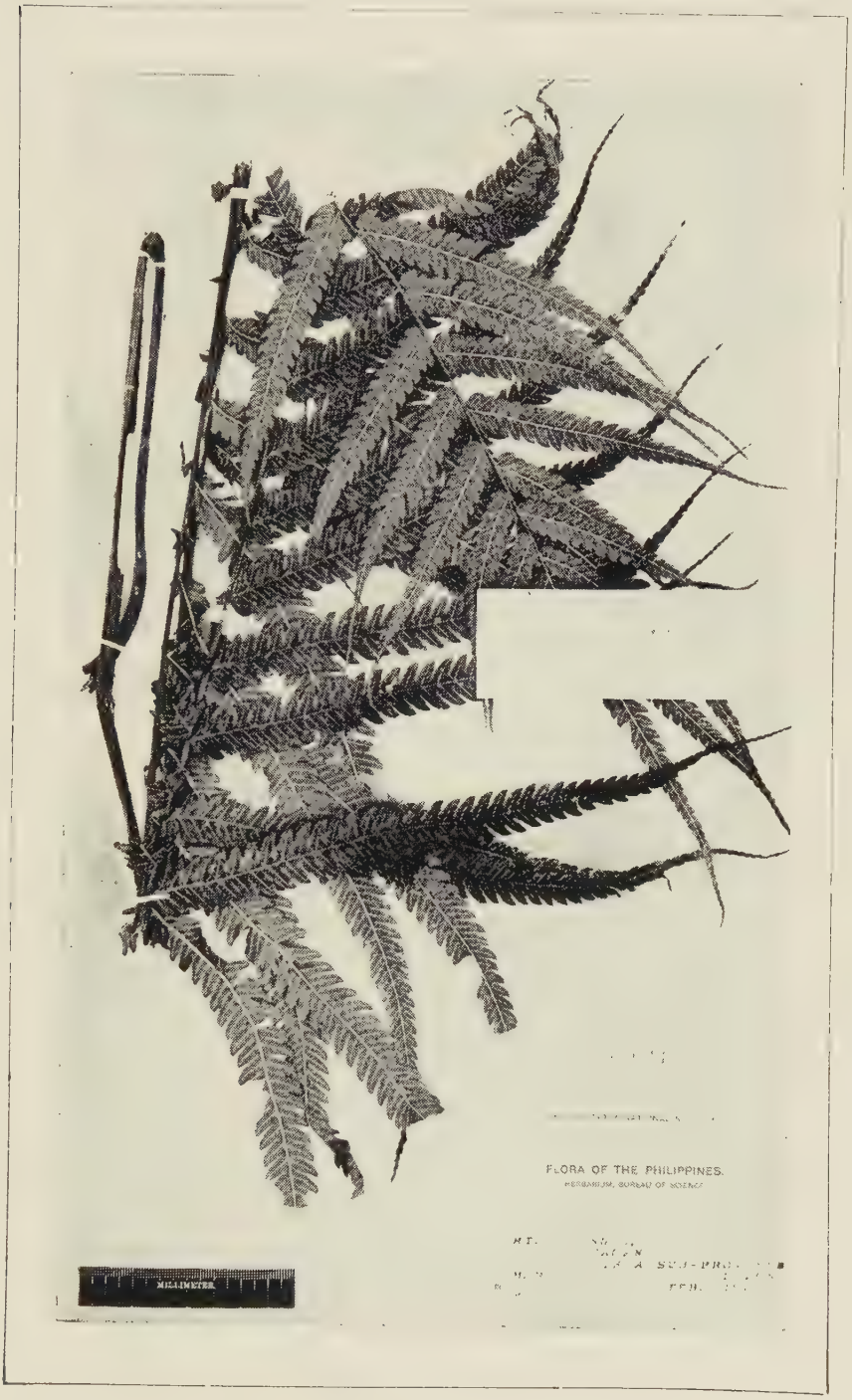

PLATE 24.

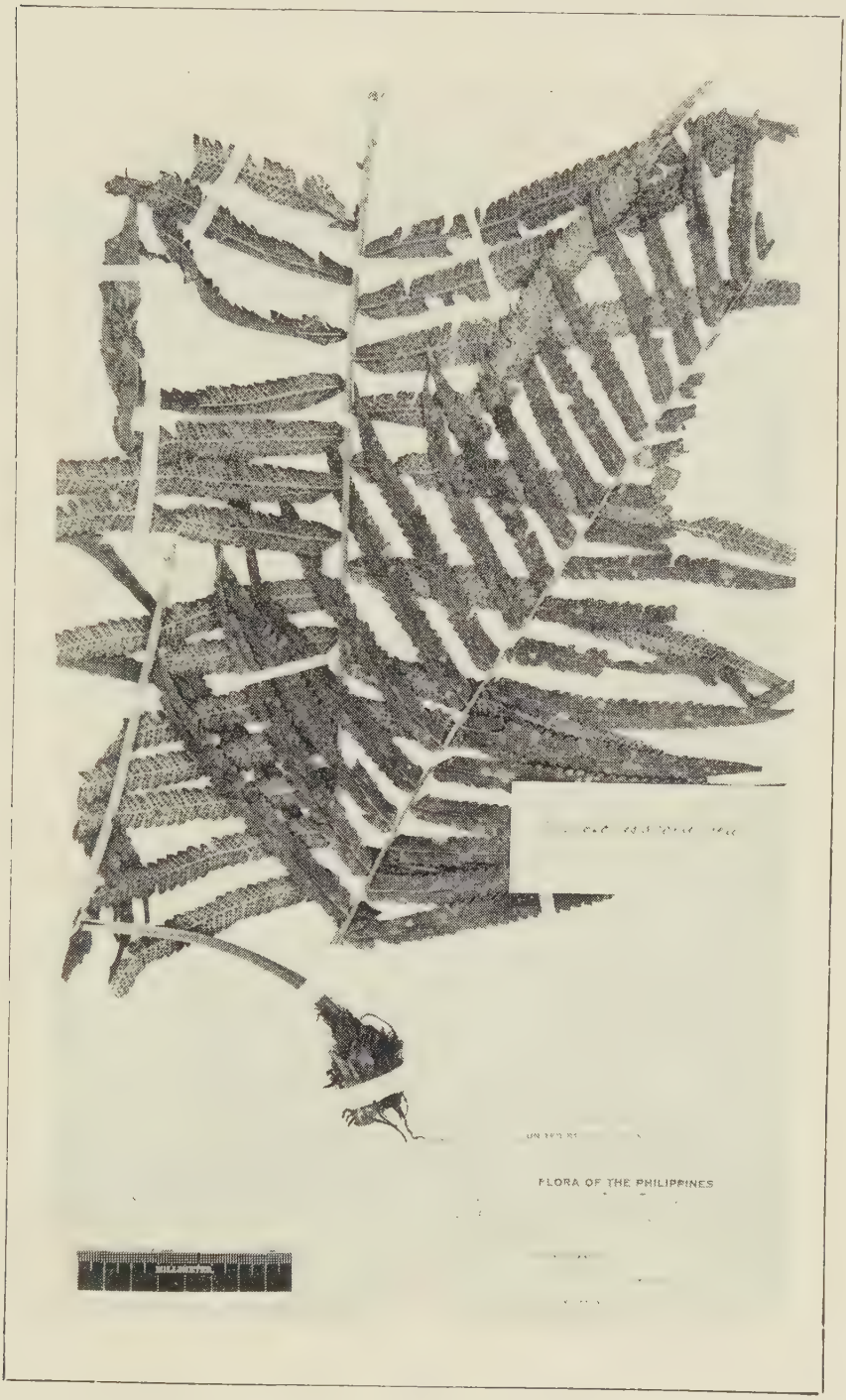

PLATE 25.

PLATE 26.

more probably Neolithic in age, although possibly Mesolithic. They were poorly made tools. One gained the impression that they were fashioned from a relatively less docile material by a folk who could have done better with good flint. However, the fact that only such heavier tools as ground adzes and chisels are well made, whereas all the chipped tools of the area are crude, inclines us to think rather of the greater attention which must have been paid to artifacts made of wood (especially the useful bamboo; a similar difference in emphasis has been pointed out by one of us for a very different part of the world.[1]

The adze was found a short distance south of the Matibot River, which empties into the sea less than a kilometer south of Madalag Point. The site is approximately seventeen kilometers by road north of the town of Sindangan, which gives its name to the general area. The adze was a surface find, on a very low hill, less than a quarter of a kilometer inland.

The artifact is of fine-grained basalt, a recent nick in the cutting edge allowing us to view a fresh surface, beneath the patination. The cross-section of the adze is sub-rectangular. The tool is of the plain-backed variety; i.e., there is no step or ridge on the dorsal surface. Following Beyer's typology, we would, therefore, classify the adze as an "early Late Neolithic" form. This is the form of the adzes previously found in the Sindangan area.[2] As a matter of fact, no stepped or shouldered adzes have so far been found in western Mindanao. We hesitate to draw a conclusion from this negative evidence. However, one of us (J. F. E.) made such extensive surface and excavational investigations in this area, that we should regard the discovery of a stepped or shouldered adze here with considerable interest, if not surprise. According to Beyer, the early Late Neolithic culture probably entered the Philippines "chiefly from the south and west (through Borneo, or direct from Indo-China), between 1750 and 1250 B.C."[3] The plain-backed adze is predominant among objects collected in Borneo[4]; its absence on the islands of the Sulu Archipelago offers no difficulty against a probable migration-route having existed there. In addition to lack of investigators, we note the common phenomenon of the collection and hiding of such ob-

[1] Namely, the Lebanon. Ewing (1949) 281.
[2] Beyer (1947) 318.
[3] Beyer (1948) 82.
[4] Beyer (1947) 340.

jects, considered to be endowed with magical powers, by the people of the area.

The following detailed description follows the system elaborated by one of us.[1]

Somatic outline.—see the Figure. *Cross-section.*—sub-rectangular. Ventral and dorsal surfaces are slightly convex; surface junctures are sharp.

Cutting-edge outline.—convex and oblique. *Bevel: single.* The bevel angle is about 15°. Its transverse shape is slightly convex, and its proximal margin is evident. *Blade-butt boundary.*— not evident, except by hafting (?) notch in left side.

Butt.—plain; that is, both its ventral and its dorsal surfaces are continuous with the adjoining surfaces of the blade. There is a notch in the left side, presumably to facilitate hafting; this is not true shouldering of the butt.

Poll outline.—plan and oblique. The poll surface appears to be the original striking platform.

Material.—fine-grained basalt. *Weathering.*—light, greenish-brown patina; little etching. *Dimensions* (maximum).—Length, 15.6 cm; Width, 7.9 cm (across blade, at cutting edge); Thickness, 1.4 cm (through butt, 3.5 cm from poll surface).

Probable technique of manufacture.—flake struck from core-block, finished by chipping, (bruising?), rough grinding, smooth grinding—almost to point of polishing.

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[1] Lynch (1949) 63–67, *esp.*

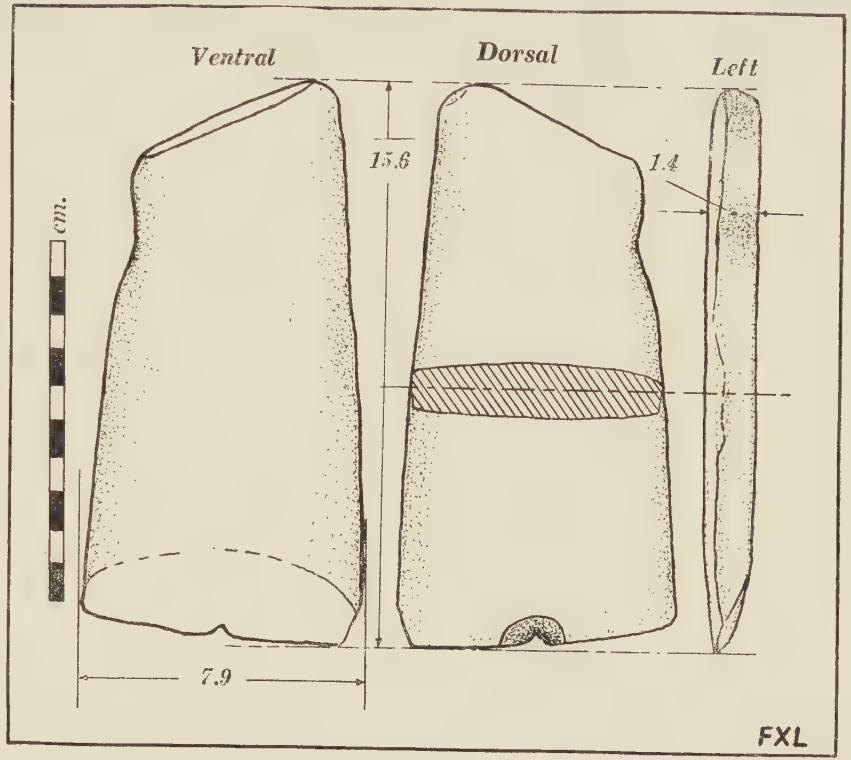

PLATE 1. A NEOLITHIC ADZE FROM MINDANAO.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF HEALTH
PUBLIC HEALTH RESEARCH LABORATORIES
DIVISION OF MALARIA
MANILA, PHILIPPINES

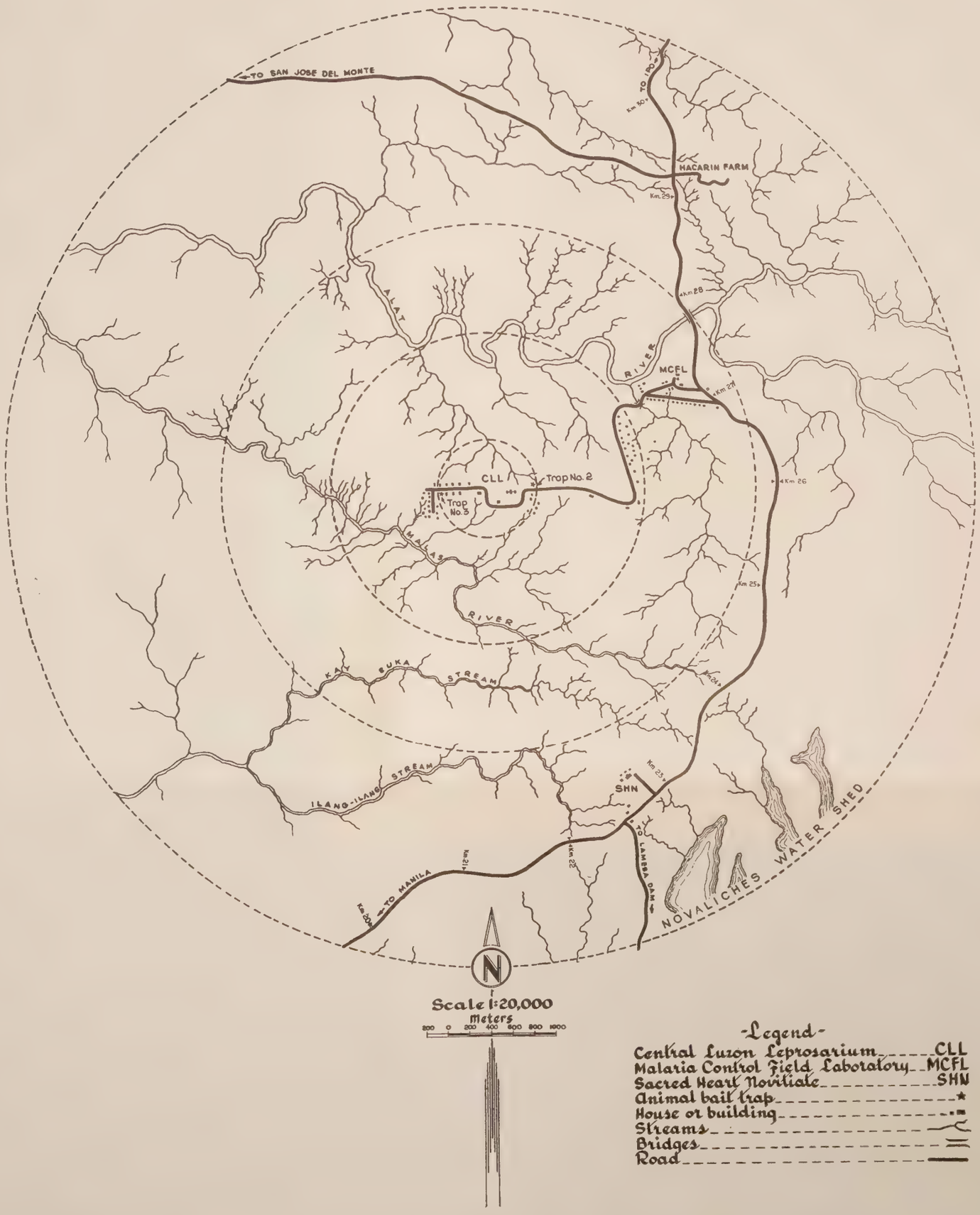

FIG. 1. Sketch map of Central Luzon Leprosarium control area and environs, prepared by A. Amante, *Sanitary Engineer.*

OBSERVATION ON SUPPOSEDLY UNUSUAL BREEDING OF THE PHILIPPINE MALARIA VECTOR[1]

By Jose B. Mendoza and Benito Abinoja
Of the Division of Malaria, Public Health Research Laboratories
Department of Health, Manila

ONE TEXT FIGURE

Anopheles minimus Edwards *flavirostris* (Ludlow),[2] the principal malaria vector in the Philippines, has always been assumed to breed only in partially shaded slow-flowing fresh-water streams since Walker and Barber (1914) rediscovered the importance of this mosquito in connection with the disease in the Philippines. Since then, all control measures instituted against the larvæ have been directed exclusively on these breeding places.

In the Central Luzon Leprosarium, control against the larvæ *of A. minimus flavirostris* had been resumed one year prior to the experiment presented in this paper. The area[3] covered included the leprosarium compound as the center and the outlying area over a radius of one and a half kilometers. Clearing, sluicing, and limited DDT spraying (for experimental purposes) were the principal anti-larval measures used.

Two carabao-baited traps which had been used before and during the last war (traps 2 and 3, see map), were reconditioned and put into operation. A carabao was placed in each trap and the door left open from 8:00 p. m. to 4:30 a. m. The mosquitoes were caught, identified, and counted each morning, except on Sundays and holidays. The adult density, as used in the present paper, is equal to the total catches of a particular species divided by the number of trapping hours. All streams within the control area were checked once a week for

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[1] This work was undertaken at the Malaria Control Field Laboratory (now Malaria Field Center) at Tala, Novaliches, Rizal.

[2] The following were the early terminologies applied to *A. minimus flavirostris:*

Myzomyia funesta Whitmore (in part), 1904.
Myzomyia flavirostris Ludlow, 1914.
A. febrifera Banks (in part), 1914.
A. febrifer Walker and Barber, 1914.
A. (*Myzomyia*) *christophersi* Ludlow (in part), 1915.
A. minimus Edwards, 1915.
A. minimus var. *aconitas* Christophers, 1916.
A. funesta Manalang (in part), 1930.

[3] Contiguous to this area, breeding places of the vector were almost as abundant as in the control area. See map.

Anopheles larvæ. The larval density, as employed here, represents the total number of larvæ of a particular species caught divided by the total number of samplings.

At the end of one year, the control measures instituted resulted in reduction of the larvæ of the vector to almost nil (from 0.0644 in 1946 to 0.0026 in 1947) in the streams. On the other hand, the adult density was only slightly affected (from 8.62 in 1946 to 1.78 in 1947 in trap 2 and from 6.75 in 1946 to 2.07 in 1947 in trap 3). The appearance of freshly emerged male adults together with the females in the traps pointed to existence of unsuspected breeding places close at hand. This puzzling condition accordingly prompted us to examine other bodies of water that had not previously been known ordinarily to serve as breeding places. To our surprise, the larvæ were found in pools, carabao foot-prints and similar collections of water not far from our traps. Although this apparently aberrant breeding habit had been recorded before, some believed that the larvæ were there by accident, perhaps carried by an overflow, and also probably, after at most a few molts, they would eventually die prematurely.

More detailed observations were carried on from December, 1946, to June, 1947, in the Central Luzon Leprosarium. Rainfall was lowest during this period. Two kinds of pools were used: (1) man-made and (2) natural. The man-made pools were actually shallow wells built by digging small holes of about one-half to one meter deep and a meter in diameter, on low places where the water table was flush with the surface of nearby streams and thus kept from early drying. The natural pools were small seepage collections of water from the underlying water table and were not fed directly by a stream. Some of them were the left-overs of a retreating stream as it dried up in the dry season. To exclude larvæ and eggs that had existed there before the pool became isolated, only those pools that had been impounded not less than three weeks previously were selected. The pools or wells were distributed at different places, from a few meters to 100 meters removed from the Alat stream and tributaries at a distance of one kilometer from the leprosarium compound.[4]

Springs or spring water and pools fed by overflow of any type of water, as well as seepages, were disregarded. Inflow or overflow was carefully guarded against. When this happened, the breeding place was abandoned to be sure that only data from the wells or pools maintained by the natural water

[4] See map.

table were used. In many instances, the recession of the water table was so rapid that only one to three weekly observations could be made. In others, the wells or pools continued to hold water until the onset of the rainy season, when, of course, observations on the breeding places were abandoned. About one half of the natural pools were partially shaded and the rest, exposed to sunshine. The same condition obtained in the man-made pools. Partial shading was afforded by the natural growth of the surrounding vegetation which consisted mainly of cogon grass and low growing trees. Total exposure was either natural or effected by cutting the surrounding vegetation to admit full sunlight most of the day.

All the breeding places were left open and freely accessible to mosquitoes. Every seven days, each breeding place was checked for Anopheles larvæ and catches were brought to the laboratory for identification and counting. Only the fourth-instar larvæ of *A. minimus flavirostris* were saved and bred in the laboratory.

RESULT

A. minimus flavirostris larvæ collected and reared from unusual breeding places.

Type of breeding place	No. of breeding places	No. of weekly checkings	4th instar larvæ collected	Imagines reared
1. Man-made wells:				
(*a*) Partially shaded	15	164	136	11
(*b*) Entirely exposed	26	346	318	19
2. Natural pools:				
(*a*) Partially shaded	4	37	17	1
(*b*) Entirely exposed	9	85	9	0

There were 41 man-made wells where 510 weekly checkings were made. From these, 136 fourth instar larvæ of *A. minimus flavirostris* were collected and brought to the laboratory for rearing. Of these, 30 emerged out into adults.[1] From

[1] At that time, DDT was still new in the Philippines. Without much experience with it, DDT spray was prepared just around the laboratory where larvæ were being reared. A technician who had been assigned to the rearing of *A. litoralis* larvæ before the war resumed rearing the same mosquito in the same laboratory. To his surprise, there was a tremendous mortality of the larvæ. At the writing of this experiment, which was over a year after its conclusion, a rearing house was constructed 300 meters away where buildings and trees occupied the intervening space. Rearing of adults from the larvæ in this new place was as successful as in pre-war days.

the 15 partially shaded dug wells, 164 weekly checkings were made and 136 fourth instar larvæ of the vector were collected, 11 of which emerged out into adults. There were 26 wells entirely exposed to sunshine from which 346 weekly checkings were made and 318 fourth instar larvæ of the vector were collected, 19 of which emerged out into adults.

There were 13 natural pools (existing before the start of the experiment, not man-made nor temporarily created by rainfall) in which 122 checkings were made. There were 26 fourth instar larvæ of the vector collected of which only 1 adult emerged out. From the natural but partially shaded pools, 37 weekly checkings were made and 17 fourth instar larvæ were collected from which the only adult emerged out. From the nine natural but entirely exposed pools, 85 weekly checkings were made and nine fourth instar larvæ were collected of which none emerged out.

DISCUSSION

P. F. Russell (1934) cited an early report in 1904 by Lt. E. R. Whitmore who associated *Myzomyia funesta* (later known to be *A. minimus flavirostris*) with the streams. C. S. Banks (1914), E. L. Walker and M. A. Barber (1914), C. Manalang (1929), P. F. Russell and F. E. Baisas (1934) and others made the same observation. P. F. Russell and D. Santiago (1928), P. F. Russell and F. E. Baisas (1934), J. Mendiola and others (personal interviews) found the larvæ in wells. In a malaria seminar in Manila in 1947, C. Urbino reported having found them in brackish water. This was later confirmed by H. F. Smith, F. J. Dy and F. G. del Rosario (1950) who, in addition, found them in rice fields and hot-water springs. Dr. G. Adan and co-workers also found the larvæ in rice fields and pools from time to time. Because of the close association of the typical breeding places with the a typical ones, and added to this the rainy season, the suspicion of possible mechanical introduction was very strong. On the other hand, when this factor was remote, their presence in other types of breeding places was not given any importance. This contention paralleled the view of R. C. M. Thompson (1940) with *A. minimus* (*typicus*) in that, its presence in other types of breeding places was qualitatively interesting but quantitatively unimportant. It was not ascertained, however, if this view would hold even with the increase of gametocytes or susceptibles.

The studies showed that *A. minimus flavirostris,* of its own accord, lays eggs in superficial dug wells and pools. These eggs develop in these breeding places into the fourth-instar larvæ, which are capable of emerging as adults. We found that *A. minimus flavirostris,* though ordinarily a stream breeder, was also a facultative breeder in pools or dug wells. It agrees with the premise of B. A. R. Gater (1934) that, although Anopheles mosquitoes exhibit definite preference for a particular type of breeding place, they show great powers of adaptation. It should be recalled that, for about a year prior to the experiment, the adult density of the vector species [1] was unusually high, even surpassing their densities before any control measures had ever been instituted (one year before the experiment, 8.62 in trap 2 and 6.72 in trap 3 and, during the experiment, 1.78 and 2.07, respectively). Whether there could be a proportionate breeding with decreased density of the vector or not, we did not determine. Qualitatively, the supposed unusual breeding was not influenced by the biological control instituted at the time of the experiment because others have previously observed the same occurrence in uncontrolled areas.

Long standing pools and wells were found not as inviting as recent ones to the particular mosquito ($P=<.01$) [2]. This was probably the reason why the larvæ of this mosquito were not often encountered in natural pools or wells. The mosquito did not show a significant preference for either partial or total exposure.

Whether the breeding of the vector in the alleged unusual breeding places was natural or forced by the adverse conditions brought about by the biological control, the breeding in these

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[1] The other species of Anopheles increased also.

[2]

Kind of breeding place	No. of checkings	Observed collections	Expected collections	Percentage
Man-made wells	510	454	387	
Natural pools	122	26	93	
	632	480		79.95

$$X = \frac{(454-387)^2}{387} + \frac{(26-93)^2}{93} = \frac{67^2}{387} + \frac{67^2}{93}$$

$$= \frac{4,489}{387} + \frac{4,489}{83} = \frac{417,477 + 1,737,243}{35,991} = \frac{2,154,720}{35,991}$$

$= 60$

d.f. $= 1$

$P = <.01$

places was our point of interest. In the first place, it clarified the doubt of those who thought the presence of the larvæ in these places was accidental and, secondly, it belied the presumption that, after a few molts, the larvæ would eventually die.

SUMMARY

In the Central Luzon Leprosarium where biological control measures were instituted on streams, the typical breeding places of the Philippine malaria vector (*A. minimus flavirostris*), in an area covering one and one-half kilometers around the leprosarium compound, it was noted that, when these breeding places were under control, the adult population remained slightly affected at the end of one year. Adult catches from carabao-baited traps around the compound showed, not only newly hatched adults, but also the males of the vector, indicative of a nearby breeding place. A check-up on bodies of water other than the typical breeding places revealed the presence of the larvæ in pools, carabao-footprints and similar collections of water not far from the traps. Similar findings have at times been previously reported but the presence of the larvæ in these places was always presumed to be accidental. This condition led us to test whether the vector mosquito could lay its eggs in unusually known breeding places like pools, dug wells or holes containing water and whether under these conditions, the eggs could develop into the fourth instar larvæ or not. The experiment showed that *A. minimus flavirostris* would lay its eggs in these unusual breeding places and the eggs could develop normally into adults.

ACKNOWLEDGMENT

We are particularly thankful to Dr. Antonio Ejercito, Chief of the Division of Malaria, for the inspiration and guidance that led to the final publication of this paper. We also received invaluable criticism from Drs. Manuel F. Ingco, Gerardo Adan, and Milagros de Guzman, and Messrs. F. E. Baisas and C. Urbino. The map was prepared by Engineer Ambrosio Amante and malaria technician Diosdado Bagtas.

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FORMOSAN SCOLYTOIDEA, I

III. CONTRIBUTION TO THE MORPHOLOGY AND TAXONOMY OF THE SCOLYTOIDEA

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The late Forstrat Eggers studied quite a number of Scolytidae from Formosa and described a number of new species, but he died without completing his work and a number of specimens were left for further investigation. The results of my examination are given below and some correctional notes added.

ERRATA CORRIGENDA

1. *Scolytoplatypus muticus* Hagedorn, Bull. Paris X (1904) 124, is synonymous to *Scolytus daimo* Blandf., Trans. Ent. Soc. London (1893) 433.

According to a note found in a manuscript of the late Forstrat Eggers, a fact which is very important now as Hagedorn types were destroyed during the war.

2. Ouchi Yoshio, in 1935, Supplements to bibliographical introduction to the study of Chinese insects, Entomological Part, No. 3, Journal Shanghai Science Institute, Section III 3 (1936) 204, refers to *Xyleborus tonkinensis* sp. nov., giving as the author Eggers, Ent. Blätt. 30 (1934) 39. This statement is misleading inasmuch as the author to which the citation of the original description does apply is not Eggers but Schedl.
3. *Webbia 14-spinatus* Schedl, Kol. Forstl. Mitt. 5 (1924) 182, should be replaced by *Webbia 14-costatus* nom. nov. The former name is preoccupied by Sampson.
4. *Xyleborus formosanus* Eggers, *in litt.*, is synonymous with *Xyleborus mancus* Blandf. Eggers referred to this species in Arb. morph. tax. Ent. Berlin-Dahlem 6 (1939) 114, and I mentioned it in Mitt. Zool. Mus. Berlin 23 (1938) 463, but no description has been published and there is no manuscript description left by Eggers. Studying a metatype of this species more closely, I found that it fits very well in *Xyleborus mancus* Blandf. *Xyleborus formosanus* Eggers, *in litt.*, therefore, is a *nomen nudum* and has

no significance. This also applies to the type of this species in the Deutsche Entomologische Institut in Berlin and also to some specimens returned to Mr. Y. Chujo under this name.

NEW RECORDS

STEPHANODERES JAVANUS Eggers

Taihoku, April 16, 1928, (*J. Sonan*) and April 20, 1932 (*M. Chujo*).

XYLEBORUS METACUNEOLUS Eggers

Taihoku, May 7, 1929 (*R. Takahashi*).

XYLEBORUS FORNICATUS Eichh.

Mt. Kappan-Zan, November 12, 1935, ex *Camelia thea* (*J. Sonan*).

XYLEBORUS SEXSPINOSUS Motsch.

Kusukusu, April 20, 1928 (*J. Sonan*); Chipon, March 22, 1935 (*M. Chujo*).

XYLEBORUS SIMILIS Ferr.

Kotosho, April 1936 (*Y. Chujo*).

XYLEBORUS MANCUS Blandf.

Taihoku, July 15, 1916 (*M. Maki*); Kuraru, March 28, 1935, (*M. Chujo*).

HYPOCRYPHALUS FORMOSANUS sp. nov.

Piceous, the color greatly obscured by whitish scales, 2.1 mm long 2.1 times as long as wide. More closely allied to *Hypocryphalus africanus* m. *in litt.* but more slender, the scales of a pale white color and the elytra more cylindrical.

Front convex, very finely aciculate, sparsely pubescent.

Pronotum wider than long (25:21), widest shortly before base, postero-lateral angles obtuse and somewhat rounded, sides arcuately convergent from shortly before base to apex, which is moderately broadly rounded, apical margin with four subequal teeth in the middle; summit high and short behind middle, anterior area deeply convex, rather densely covered with medium-sized asperities, intermixed with fine erect setæ, basal area very densely punctulate and with short inclined scales. Scutellum large, scarcely wider than long.

Elytra slightly wider (28:25) and nearly twice as long as pronotum, sides parallel up to middle, apex broadly rounded, declivity commencing shortly behind middle, evenly convex; disc with subimpressed lines representing striæ, the wider interstices apparently very finely and very densely punctulate, a small stout and whitish scale arising from each puncture, these scales covering most of the surface; interstices on declivity aside from scale-like vestiture, each with a row of short, erect yellow hairs.

Type in coll. Schedl.

FORMOSA, Riran, November 18, 1925 (*R. Takahashi*).

STEPHANODERES TAIHOKUENSIS sp. nov.

Reddish brown, 2.0 millimeters long, 2.4 times as long as wide. Allied to *Stephanoderes sundænsis* Eggers, but much larger and more slender, the pronotum anteriorly more densely asperate, and the pubescence of the elytra comparatively shorter and more regular in arrangement.

Front convex, rather densely and finely punctured, very sparsely pubescent.

Pronotum wider than long (24:19), widest shortly before base, postero-lateral angles rectangular with apices feebly rounded, sides feebly arcuate, subparallel on basal third, thence strongly incurved to moderately broadly-rounded apex, apical margin armed with four asperities, the two median ones of which being much longer than others; summit high and in the middle, anterior area deeply convex, with asperities moderate in size and more numerous than in *Stephanoderes sundænsis* Eggers, basal area very densely granulate-punctate, pubescence short and rather inconspicuous. Scutellum triangular and rather small.

Elytra but slightly wider (25:24) and twice as long as pronotum, sides to somewhat beyond the middle parallel, thence strongly incurved to narrowly rounded apex, declivity commencing behind middle, obliquely convex; disc with rows of rather small punctures in subimpressed lines, interstices each with a row of much smaller punctures bearing moderately long, erect and fine setæ; declivity with the striæ somewhat deeper but the punctures not decidedly larger, the setæ more conspicuous.

Type in collection Schedl.

FORMOSA, Taihoku, April 20, 1932 (*M. Chujo*).

ORIOSIOTES FORMOSANUS sp. nov.

Reddish brown, 2.24 millimeters long, 2.6 times as long as wide. More closely allied to *Oriosiotes mindorœnsis* m. *in litt.* but the elytra with the interstitial punctures much smaller, the declivity with the second interstice impressed, and the granules very sparse.

Front plano-convex, granulate-punctate, with a fringe of yellow hairs along the epistomal margin and some remotely placed similar setæ on sides toward eyes.

Pronotum as long as wide, appearing much more slender owing to peculiar outline, postero-lateral angles rectangular and very feebly rounded, sides parallel at basal half, thence rather

strongly convergent in nearly oblique lines, apex moderately broadly rounded; summit in middle, anterior area but moderately convex and covered by small asperities, basal area long, densely covered with rather large punctures; pubescence moderately short, erect, greatly abradad. Scutellum small.

Elytra but feebly wider and 1.7 times as long as pronotum, cylindrical on its greater part, apex broadly rounded, declivity commencing behind middle, deeply convex; disc with rows of moderate-sized and rather closely placed punctures, first two striæ more distinctly impressed, the others hardly so, interstices moderately wide, each with a fairly regular row of much finer and more remotely placed punctures, hence, the two series easy to recognize; declivity with suture somewhat elevated and with a series of small granules on each side, space along second interstices feebly impressed, granules smaller than those of suture, third forming low lateral convexities, granules also very small, additional granules on sides, pubescene restricted to interstitial punctures and granules, more conspicuous on declivity.

Type in coll. Schedl.

FORMOSA, Rikiriki, March 29, 1924 (*N. Takeda*).

XYLEBORUS TAICHUENSIS sp. nov.

Female.—Dark reddish brown, 1.8 millimeters long, 2.24 times as long as wide. More closely allied to *Xyleborus mucronatus* Eggers and *X. ciliatus* Eggers, the pronotum more like the former species, the elytra similar to the latter, but the teeth much more developed.

Front convex, minutely punctulate, with very short and sparse pubescence anteriorly.

Pronotum slightly wider than long (23.5 : 19.0), postero-lateral angles obtuse, feebly rounded, subparallel, feebly arcuate on basal two-fifths, apex broadly rounded, anterior margin with four to six asperities, the two median of which somewhat larger; summit rather high and in middle, anterior area deeply convex and finely asperate, basal area with a minute punctulate ground sculpture and shallow, fairly fine punctuation; pubescence very short and inconspicuous. Scutellum moderate in size, about as long as wide.

Elytra as wide and nearly 1.8 times as long as pronotum, sides to middle parallel, thence feebly convergent, apex somewhat angulately rounded, apical margin up to the seventh interstice acute, declivity commencing somewhat before middle,

opaque and very obliquely convex; with rows of rather fine and remotely placed punctures on short disc, interstices wide and uniseriately punctured, punctures but little smaller than those of striæ, the latter becoming feebly impressed toward declivity; second and fourth interstices widely elevated at the beginning of declivity, fourth continued further behind and both abruptly ceasing and produced into short spines, striæ more strongly impressed on declivital face, interstices more convex, especially along suture, all interstices flattening out towards apical margin; minute hairs originating from interstrial punctures hard to recognize.

Types in the collections of Schedl and Mihio Chujo.

FORMOSA, Taichu, November 2, 1936 (*T. Mitono*).

XYLEBORUS TABOENSIS sp. nov.

Female.—Reddish brown, 2.4 millimeters long, 2.25 times as long as wide. Allied to *Xyleborus onepotulus* Eggers but the anterior margin of the pronotum more transversely rounded, and the elytral declivity more steeply convex.

Front largely covered by pronotum, exposed part granulate-punctate.

Pronotum somewhat wider than long (30 : 26), widest shortly behind middle, postero-lateral angles obtuse and feebly rounded, sides weakly divergent in basal two-fifths, thence feebly convergent in oblique lines, anterior margin separately rounded and subtransverse in middle, antero-lateral angles rather well developed; summit behind middle and rather high, anterior area somewhat strongly obliquely convex, densely asperate, asperities much smaller but continued on basal area; pubescence yellow, erect and rather conspicuous. Scutellum triangular and small.

Elytra but feebly wider and about 1.6 times as long as pronotum, cylindrical to beyond middle, apex broadly rounded, declivity commencing in middle, uniformly and rather deeply convex; disc fairly shining, with regular rows of moderate-sized, shallow, and disc-like punctures, interstices wide, each with a row of but slightly smaller punctures than those of striæ, these punctures gradually replaced by minute to small setose granules towards and on declivity, striæ more distinctly impressed on declivital face, interstices subconvex, setæ rather long and yellow; apical margin acute and finely granulate up to seventh interstices.

Type in coll. Schedl.

FORMOSA, Tacho, (Rato), August 22, 1923 (*Shiraki*).

BOOKS

Books reviewed here are received from time to time by The Philippine Journal of Science and acknowledged in this section.

Electric Circuits for Engineers. By Edward K. Kraybill. New York, The Macmillan Company, 1951, 212p. Price, $3.85

Designs and applications of electrical devices are essential to engineers regardless of their fields of specialization. Electric circuits, the fundamental basis to which is reduced the analysis of most electric apparatus and appliances, need a thorough understanding, as the ability to analyze circuits is one of the most important factors in general engineering skill. This text has amply illustrated a steady-state electric circuit theory as shown by the combination of alternating current and direct current relationships into an integrated and unified whole. All subject matters are carefully arranged in their proper sequence thereby eleminating unnecessary repetition. Confusion among students is avoided. The author of the text attempts to correlate electric phenomena with that in general scientific field. Terminology, definitions and graphical symbols are taken from the *American Standard Definitions of Electrical Terms* and *Coordinated Electrical Graphical Symbols*. Diagrams, sketches and supplementary photographs are used to achieve clear presentation of the subject matter.—D. J. T.

The Invertebrates: Platyhelminthes and Rhynchocoela. By Libbie Henrietta Hyman. Vol. II, 1st ed. New York, McGraw-Hill Book Company, Inc., 1951, 550p. Price, $9.00

This volume deals particularly on the acoelomate bilateria and is divided into three chapters. The first chapter of the book is an introduction to the bilateria, dealing on its character, origin and development. The next two chapters deal on the acoelomate bilateria phylum Platyhelminthes and phylum Phynchocoela. The history, character and classification of both phyla are discussed as well as their phylogenetic considerations.

Although the author has contributed a great deal of original materials, it is generally a compilation from literature.

This volume is a useful book for advance students in biology, especially those who are interested in flatworms and nemertiness. —V. A. M.

Engineers' Dictionary. Spanish-English and English-Spanish. By Louis A. Robb. 2d ed. New York, John Wiley & Sons, Inc., 1949, 664p. Price, $12.00

This second edition of the Engineers' Dictionary covers the field of electrical and mechanical engineering much more thoroughly than the first edition. It gives a detailed coverage of radio. It also includes a brief discussion on television which is not found in the early edition. The enlarging of the book aims to bring closer to current trends all branches of civil engineering with special attention given to photogrammetry, soil mechanics and airport construction. The book contains important terms peculiar to mining, shipbuilding, logging, sugar milling and oil-field operations. Frequent references are made to chemistry, geology and metallurgy, due principally to their indispensability in engineering work. So also are terms commonly encountered in finance, insurance and transportation.

This Dictionary does not attempt to furnish definitions of the terms except in cases in which such definitions would avoid faulty equivalents or ambiguity in meaning. Its purpose is to translate names of major machinery parts from English to Spanish and vice-versa. The accepted terminology, however, does not aim to utilize perfect language if it endangers mutual understanding among workmen of different tongues. Regarding trade names, translations are also made to English terms in the way they are used in Spanish-speaking countries. Those that are very well known, with Webster's permission, are written regularly without the use of capital letters.—D. J. T.

Systematic Laboratory Course in General Chemistry. By Harry H. Sisler and Jay J. Stewart. New York, The Macmillan Company, 1950, 396p. Price, $3.50

This is a practical manual of general chemistry in which both chemical and physical properties of the elements are carefully presented and discussed. The experiments as listed, are clearly outlined using the least and simplest apparatus as far as possible but at the same time without sacrificing the theory and purpose. The exercises and questions usually found at the end of each experiment will help greatly the diligent students to understand fully the principles and methods involved in each experiment. The appendices and tables at the end of the manual are also of great help to students in the solution of the problems.

To students in elementary chemistry, this manual will be valuable as it will give them the proper training needed for beginners. The authors should be congratulated for their efforts in presenting chemistry in a very practical way.—N. F. M.

Materials of Construction for Chemical Process Industries. By James A. Lee. 1st ed. New York, McGraw-Hill Book Company, Inc., 1950 468p. Price, $6.50

To chemical engineers, plant superintendents, equipment fabricators, or other persons in charge of the selection of materials for construction of chemical process equipment, this book is of valuable aid. It is rather a time consuming work for these people to search deeply and go through a mass of technical and commercial literature dealing with the corrosion resistance of the wide variety of metallic and non-metallic construction materials and to determine which ones are most suitable for handling the corrosives involved. Even when this work is accomplished, there may be some uncertainty as to the actual performance to be expected if the individuals have no previous experience in the significant number of failures which still occurs. Most often, books and articles concerning chemical processes given only minor attention, if at all, to the performance of construction materials from the standpoint of corrosion resistance, so that a suitable knowledge of performance is not obtained at hand.

In this book the author, who in his more than 20 years' association with the chemical process industries, has exerted his effort in assembling and correlating most of the available information on construction materials used in production and handling more than 300 chemicals and chemical mixtures. The book lays emphasis on the materials of construction that have been used and have been found by actual plant experience to be the most serviceable and economical in commercial-seized plants. Aside from his experience, the author has included information from articles and reports published by engineers and other workers in actual plant practice. He has also included some unpublished materials. Where information is taken from trade literature, the author has tried to eliminate claims or estimates of performances based only upon results of laboratory corrosion tests and not confirmed by plant experience. Useful information on German plant practice with construction materials was obtained from reports of American and British teams of scientists and engineers who visited German chemical plants shortly after the second World War.

In its organization the book deals with the chemicals and chemical mixtures in alphabetical order, each as a sort of brief "chapter" so that a table of contents has not been included. Each Chapter opens with an introduction followed by three

sections: production, handling and packaging. In the first section, a preliminary discussion of the metallic and non-metallic materials used in the production of the chemical is followed by a description of the process in which construction materials are indicated for each major piece of equipment. Flowsheets are included for this purpose. The second section is concerned with the corrosiveness of the chemical product. The third section deals with material used for shipping containers. There is a directory of construction materials which includes some 550 metallic and non-metallic materials, giving trade names, manufacturer and composition or brief description.

This book should provide useful guide and reference work for all who are concerned with design, construction and maintenance of chemical process equipment as well as for engineering students.—N. F. M.

Primer of College Mathematics. By John F. Randoph. New York, The Macmillan Company, 1950, 545p. Price, $4.75

This book is primarily designed to restore unity to elementary mathematics. Such unification of algebra and its arithmetics —Trigonometry, Analytic Geometry, Differential and Integral Calculus, effectively complementing each other makes this treaties a handy yet complete reference book for any college student of mathematics. For freshmen, this book gives them an opportunity for review of the elementary operations. It also provides subject matter on permutations, combinations, probability, conic sections and solutions of triangles. In all cases, the practical application of mathematics with numerical answers are well emphasized. In order to enhance the utility of mathematics, the author has included subject matter on curve fitting and logarithmic and semi-logarithmic coordinates.

This book also deals with graphical analysis, functions, and analytic trigonometry to benefit students pursuing regular courses in calculus. The algebraic manipulation and graphical analysis applied on compound interest, present worth and laws of chance and growth are included as those are mathematical requirements for students of Education, Psychology, Economics, Business Administration, Biology and others.—D. J. T.

Elements of Fractional Distillation. By Clark Shove Robinson and Edwin Richard Gilliland. 4th ed. New York, McGraw-Hill Book Company, Inc., 1950, 492p. Price, $7.00

This book is a complete revision of the previous editions with the inclusion of new data and additional information.

One of the best features of this edition is the clear and concise treatment on the measurement, prediction, and use of vapor-liquid equilibrium compositions which covers fully a hundred pages. This subject is specially emphasized because it is believed to be one of the most serious limitations in design calculations. The chapters on the mechanical design and the performance of the fractionating column and its auxillaries will prove to be of significant value to the design engineer.

Other subjects treated are extractive and azeotropic distillation: rectification of the binary, multicomponent, and complex mixtures; alternate design methods for multi-component mixtures; batch distillation; simultaneous rectification and chemical reaction; and batch and vacuum distillation.

Throughout the book, emphasis is placed on the use of enthalpy balances and the thermodynamic approach in general. The use of illustrative problems and the incorporation of nomenclature tables and references at the end of each chapter aims to clarify and help the reader to understand more the descriptive matter discussed.

The authors have expressed the hope that "the present edition will stimulate some of the investigators to transfer their efforts to more critical problems, such as vapor-liquid equilibria, batch distillation, transient conditions within the distillation system, and column performance."—N. F. M.

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